The Electrical World.

VOL. XXXI. NEW YORK, APRIL 23, 1898. No. 17.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY,

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York.

New England Office, 620 Atlantic Ave., Boston.
Western Office, 936 Monadnock Block, Chicago.
Philadelphia Office, 929 Chestnut Street.

SUBSCRIPTION IN ADVANCE, ONE YEAR, $3.00,
In the United States, Canada or Mexico; other foreign countries, $6.00.

In requesting your address changed give OLD as well as new address.

Now in its third decade, THE ELECTRICAL WORLD is the Pioneer Electrical Journal of America, and has well maintained its lead. It has the largest Circulation of any electrical periodical, and is the best Advertising Medium.

THE ELECTRICAL WORLD'S Advertising Rates are much lower than those of any other similar publication, circulation considered, and vary according to space, position and number of insertions. Quotations promptly furnished.

Address and make drafts, orders, etc., payable to

THE ELECTRICAL WORLD,
New York City.

REMOVAL NOTICE.

The business of THE ELECTRICAL WORLD continues to grow, and therefore to require more and more space for its transaction. On May 1 the paper will remove its offices to a more pleasant and extensive home than any it has yet occupied. This will be in the recently completed—and, for the headquarters of the oldest electrical journal in America, appropriately named—"Franklin" Building, Nos. 9, 11, 13 and 15 Murray street, 150 feet from Broadway, and next to the building in which its present offices are located. Thus THE ELECTRICAL WORLD in its twenty-fifth year takes up its quarters in a new and modern skyscraper, erected on the site of its first office of a quarter of a century ago, and bearing a good old pioneer electrical name. The paper has never, by the way, occupied an office further from No. 9 Murray street than across City Hall Park. This removal to the adjoining building will not of course change the number of the telephone call—924 Cortlandt—or of the Post Office box—769—or the cable address—"Electrical," New York. Although the building covers four lots and has four numbers, THE ELECTRICAL WORLD will, for the sake of old times, use but one—its original, No. 9 Murray street. From the extra space the paper will have in its new quarters it has been able to spare a room for the use of its friends when they visit the metropolis. We shall be glad to have more of these address their mail care of THE ELECTRICAL WORLD, and there will always be a stenographer to whom they will be entirely welcome to dictate letters. Any information we can give them will, of course, be at their disposal, as it always has. The more avail themselves of the facilities provided the better we shall like it. Further reference to the new offices will be found on the next page.

VOL. XXXI. NEW YORK, APRIL 23, 1898. No. 17.

CONTENTS.

Editorials 489
A Combined Street Railway and Electric Lighting Plant at Toledo, Ohio, by W. S. Smith 491
Tests of the Power Plant of the Brockton Street Railway Company 493
Sectional Conductor Electric Railways—I., by George T. Hanchett 494
Is There Any Such Thing as "Cooling Effect"? by Alexander J. Wurts 498
The Cost of Niagara Power in Buffalo 499
Notes on the Preparations for War 499
Notes from the Colleges 500
An Electric Transmission Plant in North Carolina, by Harrie Storm 500
A High-Tension Switch, by Alex. J. Wurts 500
Digest of Current Electrical Literature, compiled by Carl Hering 501
Arc Lamps for Textile Goods Factories 505
New Developments in Independent Telephony 506
Armature Construction 506
Automatic Overhead Trolley Switch 507
A Modern Alternating Switchboard 507
Mooring Boats by Electro-Magnetic Power 507
Enclosed Alternating Arc Lamp 507
Woven Wire Brushes 507
A High-Tension Storage Battery 508
Departments:
Financial Intelligence 509
Special Correspondence 509
General News 513
Personal Notes 514
Trade and Industrial Notes 515
Business Notices 515
Illustrated Record of Electrical Patents 515

SECTIONAL CONDUCTOR ELECTRIC RAILWAYS.

In spite of the claims of the advocates of the overhead trolley there seems to be an unconfessed feeling that that method of supplying current to electric cars is inherently faulty and perhaps doomed to be eventually superseded by something better. Open conduit systems are undoubtedly successful mechanically, but are too expensive for use except under congested traffic. The number of attempts to obtain a satisfactory sectional conductor system has been enormous, and the fertility of resource shown is amazing and at times laughable. A complete account of these attempts will be found in a serial article commencing on another page of this issue.

FLYWHEEL POWER STORAGE.

An interesting method of increasing the absorption and delivery of power in a flywheel of given weight and peripheral speed is suggested by the test of the power plant of the Brockton Street Railway, abstracted in another column. The report of this test describes the running of the direct-coupled generator and flywheel, with connecting rods taken down, as a motor (with series fields left in), and states that "under these conditions the current taken by the 500-kw generator varied constantly, and part of the time it would supply current to the bus bars for a full minute at a time. * * * The changes in load on the line and the poorer regulation of the high-speed engines varied the bus-bar voltage, and some time was required for the large machine to change its speed and adjust itself to the new pressure." A possible reason for this that apparently did not occur to the writer of the report is that when the bus-bar voltage increased the motoring current running through the series fields counteracted in part the excitation of the shunt fields and tended to make the machine run still faster and therefore "motor" still harder; and, on the other hand, when the bus-bar voltage fell, the outward delivery of current increased the field excitation and tended to slow the machine up even more than would have been the case with a plain shunt-field winding. In other words, the action of the machine was such that any percentage variation of the voltage tended to change temporarily the speed of the dynamo and consequently the flywheel by a much greater percentage variation, and in that way the flywheel was retarded greatly on low voltage and accelerated greatly on high voltage, thus increasing proportionally its absorption and delivery of power.

Undoubtedly such a machine running on circuits with widely fluctuating loads, such as street-railway loads, could be made to steady the voltage quite considerably and also to steady the power called for from the generators. On over-compounded systems, however, this action would be obviously quite the reverse of that desired, as with increase of load and consequent increase of switchboard voltage the machine would absorb power and give it out again on decreased load. The action is, however, an interesting one, owing to the possibilities it suggests of the use of compound-wound motors in emergency cases where a great steadying action is desired. A danger that might be anticipated with such a combination is the entire neutralization of the shunt-field excitation by heavy motor currents. The report states that the Brockton machine required in starting 700 amperes, almost the rated capacity of the generator. This was undoubtedly due to the strong reverse action of the series fields.

ELECTRIC SUBMARINE BOATS.

It seems to be the trend of naval opinion that the most effective antagonist of the battle ship is the torpedo boat, but that existing varieties of these craft are far from as effective as they can be made. In the ordinary torpedo boat seagoing qualities and strength have been sacrificed to speed, and, in fact, every other consideration has been subordinated to that of floating the maximum power in the minimum of space. It was soon recognized that a torpedo boat which could make a speed of 35 miles an hour in a harbor could not go to sea to attack its adversary, and that its usefulness was limited by this weakness. Larger sizes of such boats, generally known as seagoing torpedo boats, and still larger sizes called "destroyers," made their appearance, but in these types the small size and handiness of the original torpedo craft were necessarily lost, and a larger and easier target was presented to the fire of the ships they were intended to attack. To be successful their attack must be made secretly, on a dark night, for example, and they are powerless in the daytime or when discovered.

It being evidently impossible to armor such boats heavily enough to stand the fire of a large vessel and yet make them light enough to attain the speeds necessary for their object, the most obvious and natural solution of the problem is to submerge the boat so that it is invisible and can make its attack unexpectedly at any time without discovery. While there have been many experiments on submarine boats it is only of late that any have been markedly successful, but it is likely that the successful working of one will revolutionize torpedo boat construction and possibly naval warfare as well. The motive power by far the best adapted to such boats is electricity, and it is proposed to call attention to some of the qualities necessary in the motive power equipment of such a craft to fit it for naval purposes.

In the first place, while there is no necessity for any such speeds in a submarine torpedo boat as those attained by its floating prototype, still much power with the smallest practicable weight and compass is requisite to enable the boat to make fair headway and to give it proper control. To be effective the boat must be totally submerged, and this means that it cannot renew its air supply without going to the surface. Consequently the source of electricity should preferably give off no fumes or gases. As such boats will naturally be small and liable to violent motion when they are at the surface the battery, of whatever kind carried, should be sealed or otherwise prevented from spilling its liquid contents, if it has any. Far better would be some form of dry battery, if this can be rendered commercially practicable.

The battery should preferably contain no corrosive fluids, since it is shut up with delicate machinery of various sorts in a confined space, and should be of such a character that it will have no injurious action upon its surroundings. It is needless to say that it should be as light as possible. This problem for their solution is only one of the many that have made electricians wonder why the only really available materials for secondary battery construction should be so heavy.

Perhaps, for this special purpose, some sort of primary battery might be found serviceable. It is not often, nowadays, that the primary battery gets a chance for usefulness, but in a service where cost is an entirely secondary consideration it might prove very effective. These boats would not need to have a great range of action, and putting a new battery in one of them would be no more serious a task than coaling a steamer or recharging an exhausted accumulator. The whole problem is as interesting as it is difficult, but its solution can very confidently be expected.

RETURNING TO ITS OLD-TIME HOME.

After May 1, 1898, the headquarters of The Electrical World will be in the new twelve story Franklin Building, just erected on the site where a quarter of a century ago the paper occupied its first office—No. 9 Murray Street, next door to its present quarters and 150 feet west of Broadway. The building is 100 by 100 feet, and the editorial and publication offices are on the tenth floor.

The first office of The Electrical World was a single room, to which from time to time as the business developed was added another and another, until the paper at last occupied seven. In 1886 it had outgrown even these and could get no more space adjoining, so it moved to the new Potter Building, just across City Hall Park. On the erection in 1889 of the Times Building, next door, The World, again seeking larger quarters, engaged offices in it. In 1894 it moved into the Postal Telegraph Building, corner Murray Street and Broadway, next door to what in the early days had been its first office and to what is to be its future home.

The old Murray street building was recently razed and with it three others adjoining, and on the four lots has been erected the Franklin Building, which is regarded as the finest structure of its class that has yet been put up, even in New York. Not only is it of unusually substantial construction and thoroughly fireproof, but electrically the building is strictly modern, even the elevators, of which there are four, being operated by electricity, as they ought to be in every well-appointed structure. The Electrical World, after so many years, during which time it has always been within almost a stone's throw of No. 9 Murray Street, has now returned to find on the old site, instead of the little old-fashioned building, an elaborate and imposing skyscraper which is to be its future home.

The Electrical World has changed its office location but four times in twenty-five years, the occasion for each change having been the necessity for larger quarters. In the Potter Building its rent was three and a half times what it had been at No. 9 Murray Street. In the Times Building to secure more space a still higher price was paid, and in the Postal Telegraph Building for more room yet a higher rent. In none of the other places, however, did the paper occupy as much space as it does in the new Franklin Building, on the site of its first office, where it has taken a long lease, in the expectation that this will be its habitation for many years to come.

The additional space has permitted of a private "spare room" being fitted up for the accommodation of out-of-town visitors. Subscribers, advertisers, representatives of business houses, and members of the electrical fraternity in general, whenever they are coming to New York, are cordially invited to have their mail addressed care of The Electrical World, and to make their headquarters at its office. Many already do this. We shall be glad hereafter to have more—far more. In the room set apart for their use they can read their letters and dictate replies to the stenographer—of course free of charge. Anything else the paper can do to assist them in the way of information or suggestions they will only have to let us know.

A Proposed 100-Mile Transmission Plant.

According to the London "Electrician," it is proposed to utilize a part of the 100,000 horse-power of the Falls of Elfkarleby for transmission to Stockholm, 100 miles distant. The estimated cost of the complete equipment for a delivery of 15,000 horse-power, including the line, machinery, and sub-stations, is $2,200,000, and it is proposed to sell the power at $11 per horse-power per year.

A Combined Street Railway and Electric Lighting Plant at Toledo, Ohio.

BY W. S. SMITH.

TOLEDO, OHIO, can justly lay claim to the distinction of being one of the pioneer cities in the application of electricity as the motive power on her street railways, the first electric road being started in 1889 by the Thomson-Houston Company, under the name of the Toledo Electric Railway Company. Two motor cars, on the service, with thirty-minute trolley system, furnished the headway, on 3 miles of track. Power for the generators was furnished by the Toledo Electric Company at a fixed price per day.

The following year the Toledo Electric Street Railway Company came into existence and laid several miles of track, equipping its road with the T.-H. system, using 10-hp D. R. motors, and as the road was finished before the completion of the power house, the company was compelled for about one year to locate its generators in different sections of the city where surplus power was available.

At the same time the three companies operating horse cars and the Toledo Electric Railway Company were consolidated under the name of the Toledo Consolidated Street Railway Company, and this company, in the effort to obtain more rapid transit, began energetic experiments with different systems of motive power; first, the Daft storage battery system was given a trial over a small portion of the road, but was found impracticable on account of expensive operation. A portion of the road was then equipped with the trolley system. Thomson-Houston D. R. motors and Eickemeyer motors, with side rod connection, were given a temporary trial, with the result that the latter were soon abandoned because of frequent and expensive repairs.

The Toledo Consolidated Street Railway Company was forced to purchase power, as was the Electric Street Railway Company, until its power house then in process of erection at the corner of Monroe and Water Streets was completed. During this time the Mekarski compressed air system was given a trial, several cars using compressed air being run for a short period, but it was soon demonstrated that no other system could compete with the trolley for speed and economy.

During 1891 the power houses of both companies were completed, and the city then began to enjoy the results of the experimental efforts of the competing companies to bring about rapid transit, and became one of the first cities in the United States to equip its entire street railway systems with electricity.

During 1895 the Toledo Consolidated Street Railway Company was reorganized under the name of the Toledo Traction Company, and in 1895 and 1896 a consolidation of interests was effected by which the Toledo Electric Company, the Western Electric Light & Power Company, and the Toledo Electric Street Railway Company, with its lighting plant, all passed under the control of the Toledo Traction Company, although still operated from independent power houses. With the merging of these different enterprises and the necessity of keeping pace with the rapid growth of the city, the Traction Company found that it had vastly outgrown its power house, and in June, 1895, ground was broken for the erection of its present magnificent station.

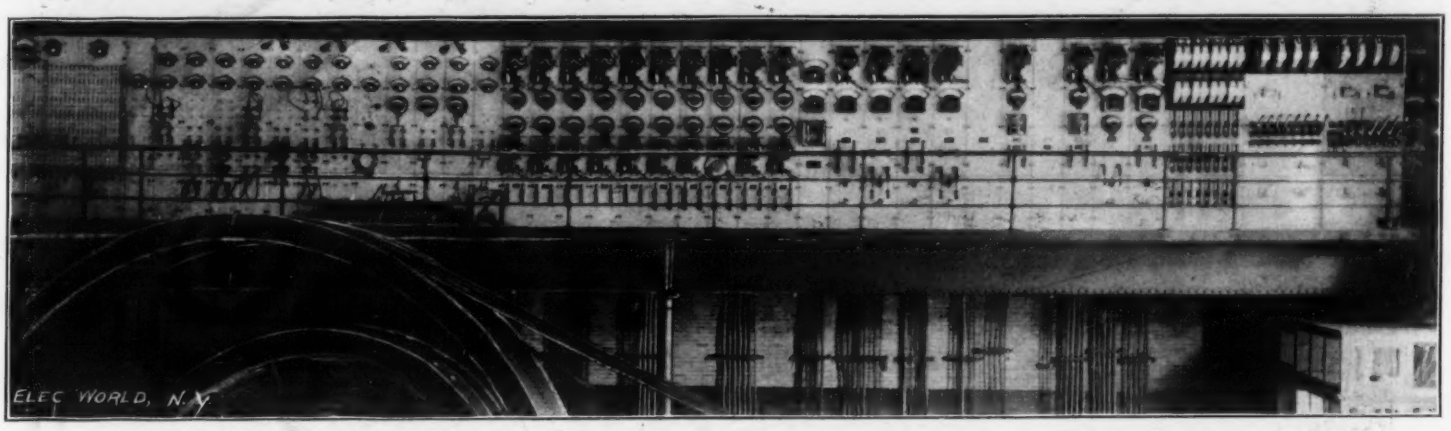
This building lies north of Madison Street, extending from Water Street to the river, with a frontage of 196 feet on Madison and 210 feet on Water Street. The walls are brick, 54 feet in height, the roof iron girders and tiling, and the floors brick and concrete; making a fireproof, substantial and imposing structure.

The boiler room, which is on the river exposure, is 40 feet wide, extending the entire length of the building, and with side windows and large doors at each end a constant circulation of air is secured for ventilation. Heine boilers, with Hawley down draft furnaces, and Stirling boilers, with McKenzie furnaces, generate the steam for the plant.

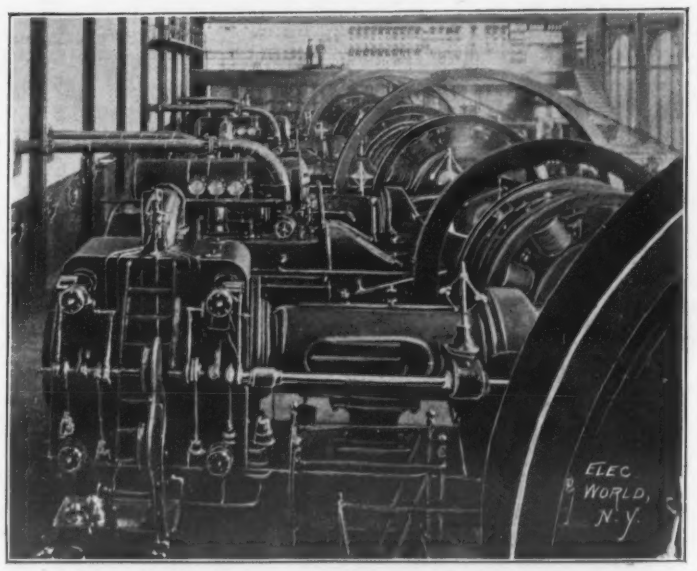
A storage bin, 10 feet 8 inches wide, located at the north end of the room, with a capacity of 400 tons, guarantees an abundant supply of coal under normal conditions. In the bottom of this bin, which is 8 feet above the boiler floor, are four hoppers through which the coal is dropped into iron carts for convenient transfer to the furnaces. All coal is weighed before being brought to the boilers, and all water is metered through two Worthington hot-water meters, thus enabling the engineer to learn each day the evaporating value of the coal used.

Two Blake vertical feed pumps, 10 inches and 7 inches x 12 inches, each capable of furnishing water for 4000-hp boiler capacity, are connected to one Webster heater and purifier of 6000-hp capacity. A Greene economizer is located near the stack, utilizing the hot gases passing from furnaces to the stack.

The large steel self-supporting stack is not only useful, but is strikingly ornamental as well, being one of the first objects to catch the eye from almost any point in the city. Its height is 206 feet above the grates, and its inside diameter is 11 feet. It is lined with firebrick



MAIN SWITCHBOARD.



VIEW OF ENGINES.

the first 90 feet, and with tile from that point to the top. The draught secured is sufficient for the entire plant under all conditions.

The engine and machine room is 70 feet wide and runs the entire length of the building. There are four American Wheelock cross-compound, two Porter-Allen tandem- compound, and one Lake Erie vertical compound engines, all condensing.

The Wheelock engines were built by Cramp & Sons, of Philadelphia. The cylinders are 18 and 48 x 48 inches, and at a speed of 90 revolutions per minute, and with normal boiler pressure of 150 pounds they will develop 1200 horse-power. Jet condensers are used, with air pumps belted to the engine shafts. The Porter-Allen engines were built by the Southwark Foundry & Machine Company, of Philadelphia. The cylinders are 15 and 36 x 30 inches, with a receiver on top. The maximum horse-power is 800. The air pumps are Blake steam pumps. The Lake Erie engine was built by the Lake Erie Engine Works, of Buffalo, N. Y. Cylinders, 19 and 38 x 32. Maximum horse-power, 1200.

For handling machinery there is one of the Brown Hoisting & Conveying Machine Company's 20-ton cranes, with two carriages of 10 tons capacity each.

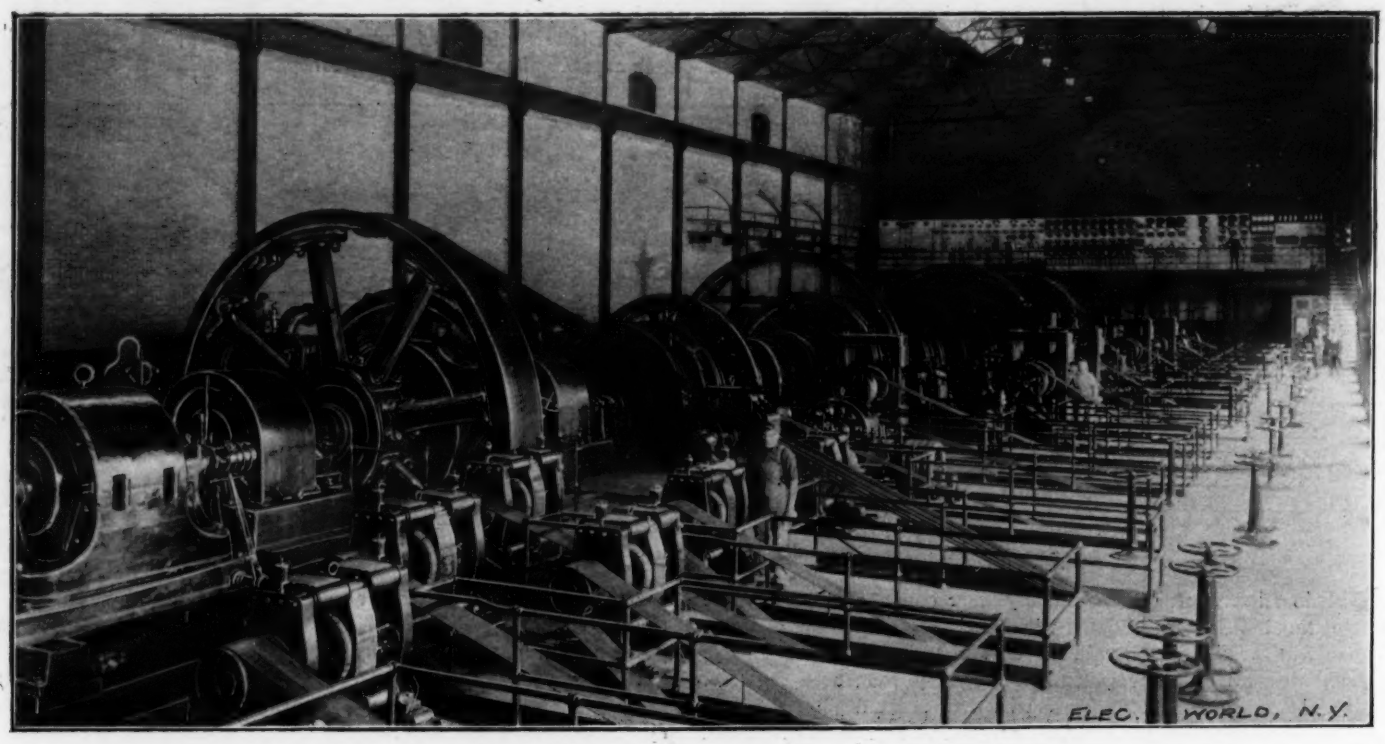
A line shaft, 198 feet long, is located in the basement. The shaft is of hammered iron, 6½ inches in diameter, and, together with the clutches, was furnished by the Hill Clutch Company, of Cleveland.

The switchboard, as shown in the illustration, is very complete and convenient. It is of white marble and extends across the south end of the engine room. The length is 70 feet and the height is 8 feet. The balcony is 14 feet above the engine room floor, thus affording the requisite view of dynamos and attendants. The board is under the continual supervision of an attendant twenty-four hours a day. On the west wall, not shown in the illustration, is the potential board, with meters, which show the drop between the station and the tubing system.

Looking from right to left, the different sections or divisions of the board are apportioned as follows:

First section, three-wire Edison system.
Second " 500-volt power.
Third " street railway (machines and feeders).
Fourth " alternating incandescent system.
Fifth or last section, constant-current arc service.

In addition to the necessary switches, ammeters, voltmeters, lightning arresters, overload switches, etc., recording wattmeters are connected to the arc alternating and power circuits on the back of the board. A large recording wattmeter is also placed between the machine and feeder bus bars on the street railway section on front of board. Recording meters have not been connected as yet for the three-wire section, special ampere readings being taken at stated in-



Machine Room of Toledo Plant, Looking Toward Switchboard.

It is divided into four sections, 42 to 57 feet in length, which may all be connected by means of friction clutches. There is a friction clutch for each pulley on the shaft. All clutches are operated from the engine room floor by the hand wheels, shown in the illustration. The line shafting is connected to the four Wheelock engines by Hoadley rope drives.

Mounted on the shaft of each Wheelock engine is a 500-kw General Electric generator. Three of these are used for street-car service only, while the fourth is kept in reserve both for street-car and power service. The power service is usually carried on this engine during the heavy demand. On the shaft of each Porter-Allen engine are two 200-kw General Electric lighting generators for feeding the three-wire underground system. The Lake Erie engine drives by belt one 6000-light alternating Westinghouse and one 5000-light alternating General Electric machines.

On each end of the line shaft are connected two 100-kw General Electric generators used for the three-wire service, and between these machines are seven 125-light Wood arc machines for street lighting, four 80-light and six 60-light Wood arc machines for commercial service, two 2000-light Westinghouse and two 2000-light General Electric alternators for incandescent service, one 175-kw Edison generator used as a booster for a local suburban line, and a 150-kw Edison and two M. P.-90 General Electric generators used for power service.

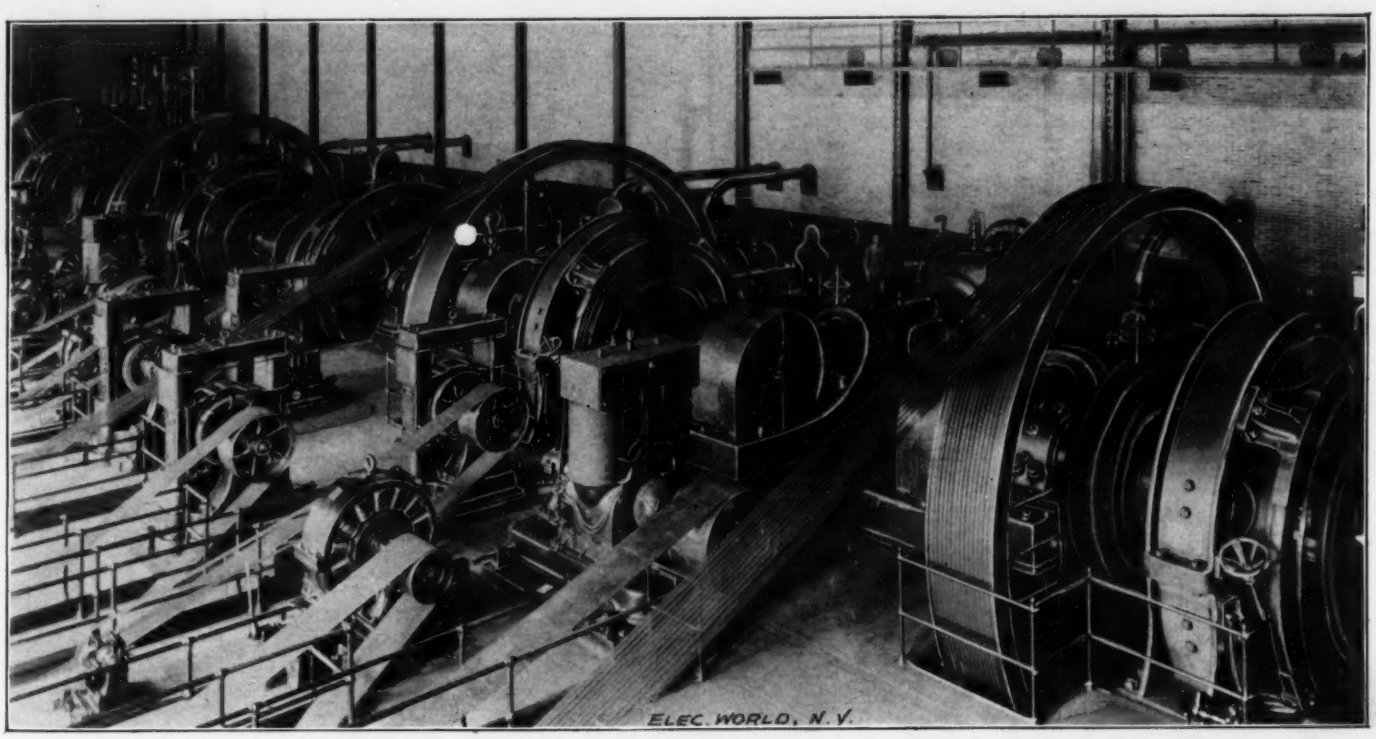
tervals, from which, on account of the almost perfect regulation of pressure, the power furnished the line can be accurately determined. By this method a record of the daily output of the station is obtained.

All wires within the main business portion of Toledo must be under ground by January 1, 1900, and conduits for these have already been constructed. The street railway feeders have been laid in these conduits to points beyond the fire limits. The electric lighting has been changed within this district from alternating and aerial lines to the three-wire underground system. Lighting feeders leave the power house in conduits and run to the man-holes in different sections of the district. Hundreds of poles have been taken down and the general appearance of the streets greatly improved. All underground feeders enter the conduits under the switchboard at the south end of the station.

This combination of street railway and lighting interests affords a more constant load than it is possible to get from either independent street railway or lighting plants. By the excellent arrangement of the apparatus a minimum amount of machinery can be run at any time for a given amount of work. The Lake Erie engine and attached dynamos are used for the alternating incandescent load during the heavy evening demand, and the Porter-Allen engines, with the direct-connected three-wire generators, are used for the direct-current load during the heavy evening demand. The arc lighting dyna-

mos are run from a shaft driven by engines that are furnishing current for street-car service. After the heavy demand of the evening is over the lighting load is thrown on the auxiliary dynamos on the shaft, the railway and the commercial lighting loads gradually diminishing, so that by midnight all lighting, power and railway current is furnished by the engines connected to the shaft. About the time that the arc lights are shut down in the morning the street railway load begins, which, together with the day power and lighting load, is run on the engines connected to the shaft until the evening lighting load becomes heavy enough to be run economically on special engines. By this arrangement of machinery, the engines can always be run at the highest point of efficiency and minimum friction loss of belting and shafting secured. As the entire output of the station and the amount of coal consumed is known for each day, it is an easy matter to ascertain the cost of coal per kw hour at the switchboard. At the end of each month the engineer in charge hands the general manager a statement of total station operating cost per kw hour for the month. The output during December, 1897, amounted to 1,192,000 kw hours; during January, 1898, 1,100,000 kw hours, and during March, 1898, 1,032,000 kw hours.

The president of the Toledo Traction Company is Mr. Albion E. Lang, who was elected to the presidency of the American Street Railway Association at its last annual meeting. Since the first of the present month Mr. Thomas H. McLean has been associated with the company as general manager and vice-president.



MACHINE ROOM OF TOLEDO PLANT FROM SWITCHBOARD.

Tests of the Power Plant of the Brockton Street Railway Company.

A pamphlet describing the recent tests made on the addition to the power plant of the street railway in Brockton, Mass. has been received from Messrs. Stone & Webster, Boston, Mass., the consulting engineers in charge of the construction of the plant. The new equipment, as described in this pamphlet, consists of three vertical boilers, with a total capacity of about 600 horse-power, one Allis-Corliss horizontal cross compound 750-hp engine coupled to one General Electric ten-pole generator of 500 kw capacity.

The tests on the generator consisted of a determination of the external characteristic, which, as plotted, shows a straight line from 495 volts at no load to about 515 with 800 amperes; also tests of the various resistances, those of the armature and series field being obtained by passing a current of about 100 amperes through these parts in series with a water rheostat, and measuring the fall of voltage. Fifteen separate readings were taken, the armature being moved slightly after each fifth reading. The average resistance of the armature and series field was 0.0205 ohm, the shunt field being 47.1 ohms.

The most interesting tests were those made to determine the efficiency of the generator, which was calculated by the stray-power method. The stray power was determined by running the machine as a motor, taking current from the other part of the plant. The connecting rods were disconnected at the crank pins and the valve rods at the rocker arms, leaving the machine in such a condition that the only moving parts were the main shaft with the armature, fly wheel and crank disc and the eccentric straps and valve rocker arms. The shunt field was then connected directly to the 500-volt bus bars, and the armature and series field coils were connected to the two in series with a large water rheostat. The resistance of the rheostat was decreased until the machine started, and was finally short-circuited when the machine was running at full speed. The stray power, exclusive of copper losses, was found to be almost exactly 27 kilowatts, and apparently assuming this stray power to be the same at all loads, and calculating the copper losses, the efficiency at various loads is worked out and given as 90.8 per cent. at full load. This seems a little high, as the shunt field loss at full voltage was about 5 kilowatts, and the armature and series field loss about 20 kilowatts, making with the 27 kilowatts stray power over 10 per cent. of the rated output of the machine. The guaranteed efficiency of the machine was 95 per cent. at full load, and the method used to derive an efficiency approximating this is interesting. The stray power, as measured, naturally included the bearing friction, and it was decided to charge all of this against the engine. This was estimated by the classical assumption that the total engine friction was at any and all loads 10 per cent. of its rated output, and that 40 per cent. of this was in the main bearings and fly-wheel wind loss. This gave 30 horse-power or 22½ kilowatts for the friction, reducing the stray power of the dynamo armature and fields to but 4½ kilowatts. With this assumption the commercial efficiency at full load was brought up to 94.6 per cent. An interesting consideration in connection with this was the fact that when the main switch was pulled the fly-wheel on the engine—weighing 30 tons—continued running for 25 or 30 minutes, in spite of the 30 horse-power lost in the main bearings at full speed.

Tests of the complete plant showed an equivalent evaporation of water from and at 212° Fahr. per pound of combustible of 11.36 pounds. The ratio of the electrical output of the generator to the indicated horse-power of the engine was 88.6 per cent. A steam consumption was found of 15.3 pounds per indicated hp hour (full load, 112 pounds steam pressure and condensing), and coal per kw hour output 2.4 pounds. The engine speed varied between 108 revolutions at full load and 112 revolutions at no load. The rise in temperature under full load eight-hour run was for the armature and commutator 34.7° C., and for the main bearings 17.7° C.

Sectional Conductor Electric Railways—I.

BY GEORGE T. HANCHETT.

The problem of supplying electric current to motor-propelled cars by other means than the unsightly but practical overhead trolley has met with nearly 600 different solutions, all of which are theoretically operative. Less than 10 per cent., however, are thoroughly practical, and only about one-half of these are free from the commercial objections of prohibitive expenditure and have a chance of finding a foothold.

Third rail and underground open conduit systems will not be discussed in this article. Each of these is an assured success in certain fields, and is beginning to be used. This article has reference to supply systems in which the moving vehicle receives its current from insulated conductors, placed at intervals along the trackway and separately connected to the feeding main at the proper time by automatic devices, but normally deprived of current or dead.

The advantages aimed for by such systems as are described below are first, moderate cost per mile, and second, a permanent way free from unsightly and dangerous devices. It is essential that the cost of a sectional conductor system be below $25,000 per mile, as for that sum an underground conduit system of less complexity can be laid, the success of which has been practically demonstrated.

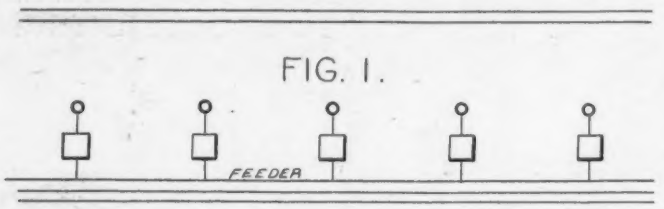


FIG. 1.

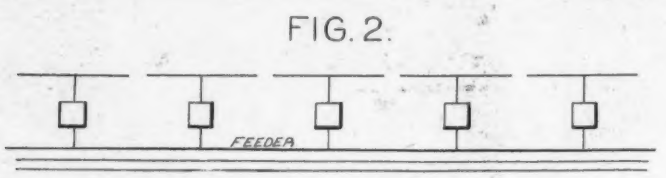


FIG. 2.

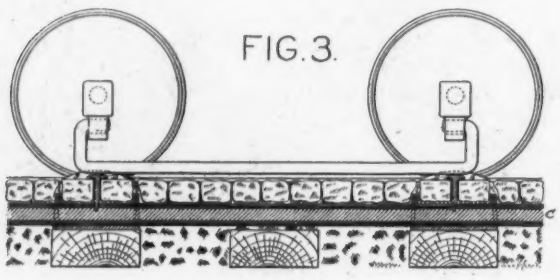


FIG. 3.

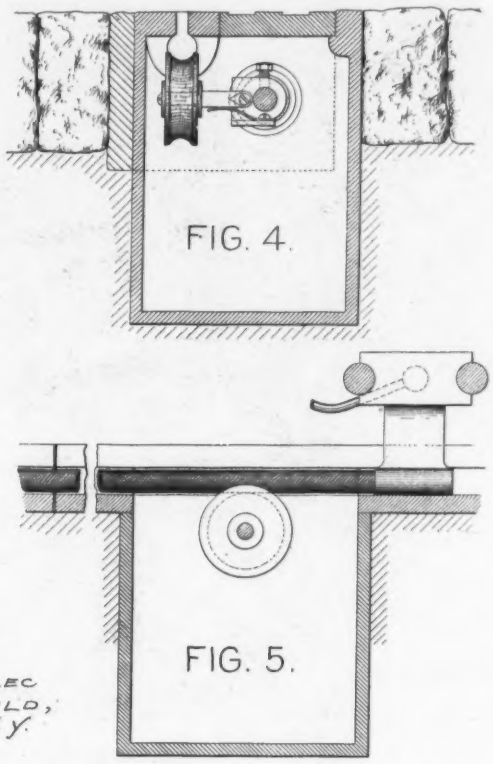


FIG. 4.

FIG. 5.

ELEC WORLD, N.Y.

Sectional conductor systems can be divided into two great classes, which are shown in diagram in Figs. 1 and 2. The first, Fig. 1, employs a series of buttons or contacts of short longitudinal extent over which long skates, moving with the car, make contact. It is obvious that these skate-shaped shoes must be sufficiently long to span the stretch from button to button as the car proceeds, in order that the supply of current may be uninterrupted. In both Figs. 1 and 2 there is shown an automatic device, which is operated in some way by the car, and normally serves to keep the button or rail section disconnected from the feeder main.

The second class, illustrated in Fig. 2, employs insulated sections of rail which are connected to the car by means of a collecting wheel or brush. The gaps between these third rails must obviously be so small that the current will be received from the rail in advance befor the brush leaves the rail in the rear. With long cars it is easy to see that two brushes may be employed, one at either end of the car, and therefore the gap between the rails may be a little less than the length of the car. With a train of cars the gap may be still longer, and in this way a limited number of sections may be made to supply a considerable length of track.

Comparing the button and the third rail systems there are the following advantages and disadvantages: In the button system there is considerably less live conductor exposed to leakage through mud and moisture which may accumulate on the track. In street car systems where the cars are of moderately short length the button system is usually less expensive to construct, because the sectional third rail system cannot employ long gap spaces. If one of the buttons should accidentally remain connected to the source of supply there would be less chance of trouble therefrom than if a length of third rail was left so connected, due to the fact that the exposed live area would be less, but it may be added that the liability of this accident is one which would condemn a system from the start and which is indeed the fatal defect of many methods.

Skates underneath a car are inconvenient devices. It is difficult to make them give good contact throughout their entire length. They should be preceded by brushes to clear the track and clean the contacts, for they would be lifted clear of the contact for a car's length by impinging on a small object. They suffer great friction, and are more expensive to renew than a brush or contact wheel. The sectional third rail system is a little more expensive to construct, but it does away with many objections to the button system. The brushes and contacts are easier to manage and keep in repair, the contact is more certain, for it is obviously easier to keep a flexibly mounted brush in contact with a stationary third rail than the reverse. If the car is at all long, or if trains are run, the use of two or more brushes will enable such long gap spaces to be placed between the lengths of sectional conductor that the sectional third rail system will closely approach the button system in first cost of permanent way. In elevated construction and places where the track difficulties common to street car service are not extensively found, it may be advisable to use a system of buttons, but even then if the cars or trains are long their only advantage (leakage having been eliminated under these better conditions) is that of first cost, and may be made to disappear.

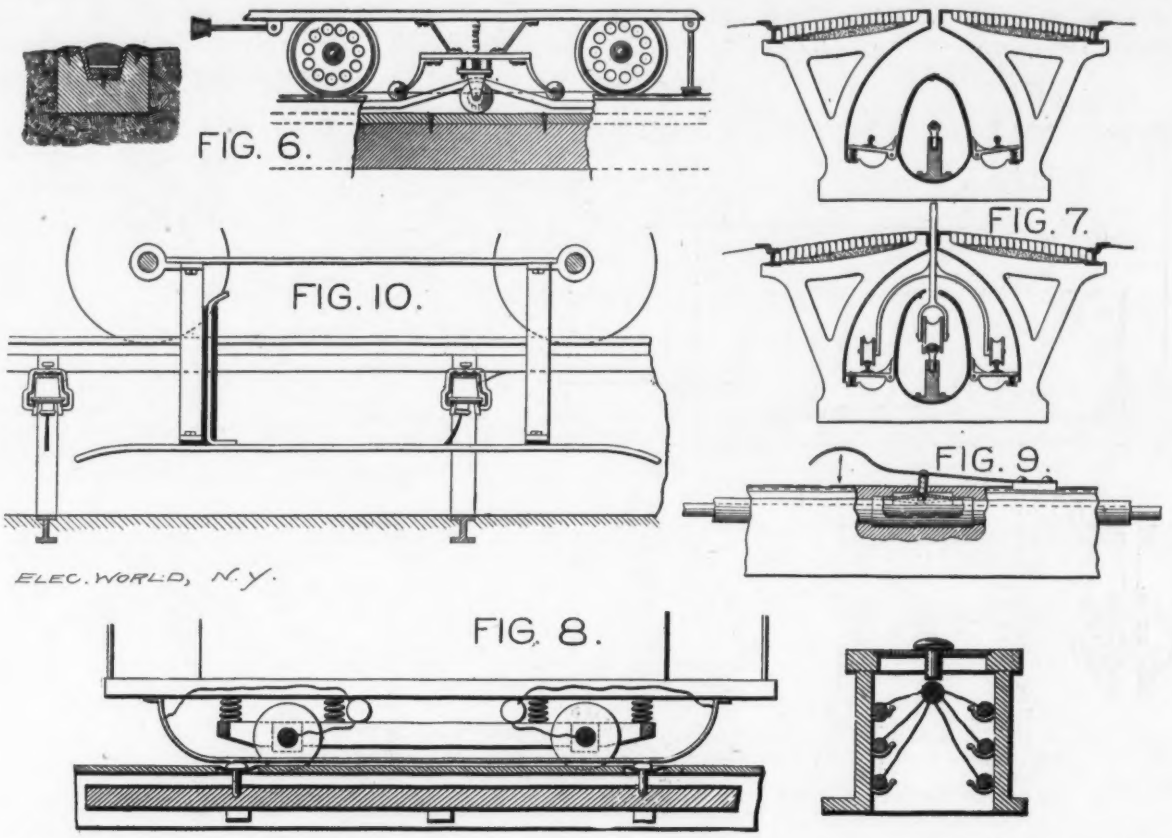
Regarding the question of leakage it is worthy of mention that this trouble, though made much of by those whose practical experience has been limited, is surprisingly small. The actual amount of current lost in this way is negligable. In extended underground conduit systems where 18 or 20 miles of conductors are continuously charged the leakage has been less than one ampere, although some sections of the conduit were flooded, the water being pure, or nearly so. Salt water, which might be encountered either from high tides or salt strewn on the tracks for the purpose of melting ice, might make the leakage more serious.

Before passing to those systems which have automatic devices, there are two modifications of the simple third rail system which should be mentioned. These consist in the inclosure of sections of third rails or buttons in such a way that only a peculiarly constructed brush or skate can reach them. These buttons or sections of third rail are continuously alive, having no automatic device; Fig. 3 illustrates an example of the protected button device. A very narrow skate is provided on the car, and it can reach into the crack in the grooved block in which the live button is located and make contact, but this crack is supposed to be narrow enough to protect the

button from contact with other things. In Figs. 4 and 5 is shown another arrangement similar in principle but different in detail. A shallow conduit is provided in the bottom of which, at intervals, are live wheels, which roll against the surface of a skate carried by the car.

A second method is to enclose the live conductor in what is known as a closed conduit. This conduit is normally closed by lids or spring doors, and these are opened by the contact plow as it proceeds and close under the influence of springs or gravity. Two examples will be sufficient. One type illustrated in Fig. 6 consists of a narrow slot normally closed by a flexible insulating strip. The contact wheel lifts this strip and makes contact, replacing it after it has passed. In Fig. 7 another type is shown, in which a pair of auxiliary wheels on the contact plow press upon rails and open the conduit as the contact wheel proceeds and springs close the conduit behind it. These, however, are not true sectional conductor systems, and may be dismissed with the above mention.

The automatic switching devices in Figs. 1 and 2 are the distinguishing features of the various sectional conductor systems. It is easy to see that there is opportunity here for great ingenuity, and



further that the fewer and the simpler these devices the more merit the system will have.

These automatic switching devices may be divided into three general classes, the first comprising those in which the control is effected mechanically by the car. In such cases a projecting member on the car impinges on some part of the mechanical connecting device and holds the rail or button in contact with the feeder while the car is passing.

The second class may be called the magnetic system, in which the automatic device is operated by the influence of a magnet or magnets carried on the car. The third is the electro-magnetic system, in which the automatic devices are electro-magnetic and are operated by current fed to them in various ways by the car. This constitutes by far the largest class. There are, further, a number of systems which operate by electro-static or electro-magnetic induction. These are essentially alternate current systems, and are for the most part entirely visionary.

Before discussing typical systems a few general principles can be considered to advantage. The restoring force, which disconnects the live conductor in all systems, mechanical, magnetic and electro-magnetic as well, should be gravity. It is a never-failing force, which has been doing business at the old stand for many years. All devices using springs or other forces than gravity for this purpose may be considered defective, for by modification the more reliable gravity methods could be employed.

One of the advantages of the mechanical and magnetic sectional conductor systems is that the leakage currents from exposed contacts cannot enter and operate the automatic devices in the vicinity, throwing the switches and leaving charged conductors in the trackway. This is a difficulty experienced in electro-magnetic systems. A mechanical system is certain in its operation if properly designed. Electro-magnetic devices of any kind whatsoever have an element of uncertainty about them which it is not easy to control. On the other hand, mechanical systems have the disadvantage that there is a liability of the switching device being operated by foreign agencies. Speaking broadly, those mechanical systems which have a depressible third rail are more liable to experience this difficulty than those employing a depressible pin or button, unless the disturbing agency is maliciously directed by some one with a knowledge of the system. Frequently circuit is broken in the automatic device, and provision should be made to minimize the arc that occurs there. This is usually accomplished by so constructing the system that the car will be taking current from another section before the circuit of the preceding section is broken. If the automatic devices are not sufficient in themselves to break the full current trouble will be experienced in case any one switch fails to close, this failure pulling an arc on the preceding switch, eventually burning it until it remains closed or open. In the latter case the arc is transferred to the next preceding and so on. For this reason contact boxes should be designed so as to provide ample means for withstanding the full arc or the latter should be minimized or transferred by suitable devices.

MECHANICAL SYSTEMS.

In mechanical systems the car operates the automatic device by mechanical means. It is evident, therefore, that the devices must be protected in some way so that nothing but the car can operate them. Sometimes this is accomplished at the expense of a conduit, which effectually bars the commercial success of the system, for its cost will be at least equal to, and probably greater than, that of a plain conduit system, which is now an assured success.

It is difficult to classify mechanical systems. They seem to separate into seven different classes, but it may be added that a number of these systems fall under two or more of these classes. They may be enumerated as follows: First, the depressible button systems; second, the depressible third rail systems; third, those systems in which either a button or rail is depressed by the action of the car wheels, closing current by appropriate levers; fourth, interconnected systems where one automatic device is controlled wholly or in part by the action of those adjacent; fifth, collapsible tube systems; sixth, magneto-mechanical systems. This includes such systems as employ an electro-magnet in connection with the mechanical device

to close the circuit or complete interconnection. Seventh, mechanically disconnected systems which do not use interconnection—that is, those systems which operate the automatic device to cut out as well as to cut in the sectional conductor directly from the car.

The movable systems are well illustrated in principle in Fig. 8. The button is mounted in the centre of a flexible diaphragm, and is depressed by a contact skate carried by the car. The ground is the return. On being depressed the button makes contact with a live feeder. It is obvious, however, that in this system any foreign agency, such as a horse's hoof, could depress the button, which would then become live. The animal would, at ordinary traction voltages, receive a shock sufficient to stun or even to kill it. Similarly a heavy wagon wheel might do some heavy short circuiting. Therefore such a system as this is entirely unadapted to street railway service, but might answer on elevated service or over private rights of way. Its simplicity renders its operation very certain, but as shown in the drawing it is difficult to provide sufficient space for blowing out an arc at one of the contact pins. Another simple system is shown in Fig. 9. A number of devices such as the figure depicts are placed at suitable intervals in a conduit, and are depressed by a skate on the car. The depressed points are so prominent that a conduit is necessary to protect them. This system is a peculiar example of insufficient provision for arcing. Suppose by some mischance the curved portion of one of the contacts was broken off, the contact would not then feed current to the shoe and the rear contact would be compelled to break the full motor current. This it could not do, the current would not be broken until the skate on the car left the end of the clip. The flexible diaphragm would be destroyed and very probably the device would be disabled, thus transferring the onus of breaking circuit on the preceding contact, which would in turn be disabled.

Another system which can be considered under the depressible button class is shown in Fig. 10. In this a brush hangs in a peculiarly shaped insulator. When the skate on the car strikes against this brush it is swung up against and touches a live contact, and after the skate has left it swings clear. The arcing for the most part will occur between the brushes and the skate, and even if a brush in advance should be worn so short that it did not make contact, and the full arc was thereby transferred to the brush preceding, it is not probable that the damage would be great, and in any event the parts could be easily removed. A modification of this system is quite practicable, but it has the expensive objection that it requires a conduit.

In such systems as this it is obvious that the more difficult it is for any blunt instrument to depress the contact and thereby make circuit, the better. Therefore both in movable button and movable third rail systems those which press the rail or button upward or laterally are better than those which depress the button directly downward, for that is the easiest motion for a blunt member inserted in the conduit to accomplish.

Another system is worthy of mention because it is typical of a class. It is shown in Fig. 11. In this system a number of trolley wheels held by forks are placed in a suitable conduit and depressed by a skate on the car. Gravity is the restoring force. The chief disadvantages of the system are that it necessitates a conduit and that the easy downward motion of the trolley wheels can be accomplished by an inserted stick or other agency.

A second and very large class of mechanically connected sectional conductor systems comprises those which use a movable third rail. An excellent example of this class is shown in Fig. 12. A stationary conductor rail is provided, and a double trolley pushes a movable third rail to one side, thus making contact with a charged stud. Gravity restores the third rail to an uncharged condition after the car has passed. A modification of this method, shown in Fig. 13, provides a separate box in which the contact is made. This system requires a conduit, but the conduit is very small, being formed on one side by the service rail itself.

In Fig. 14 is shown another mechanical sectional conductor device. In this the trolley wheel raises the third rail and in so doing depresses a lever which makes contact with the feeder main as shown. A flexible diaphragm is employed to seal the contact boxes. The contacts are arranged in boxes at intervals along the road, and a small conduit the size of the service rail is necessary. The upward motion of the rail is a good feature, inasmuch as gravity readily becomes the restoring force, and the movement is not easily accomplished by any other agency than that which was intended.

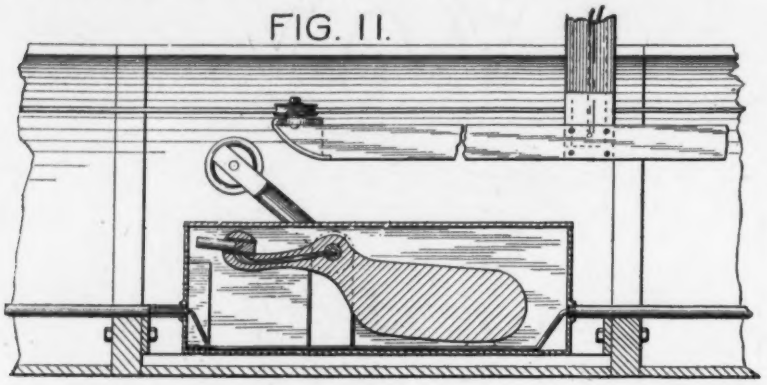


FIG. 11.

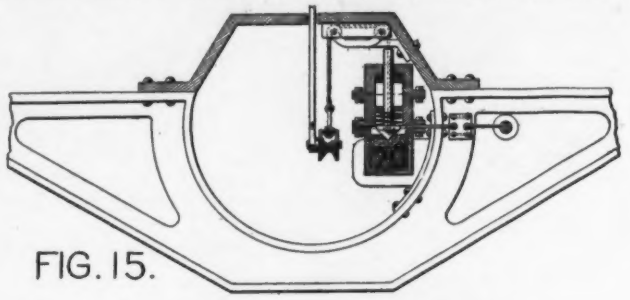


FIG. 15.

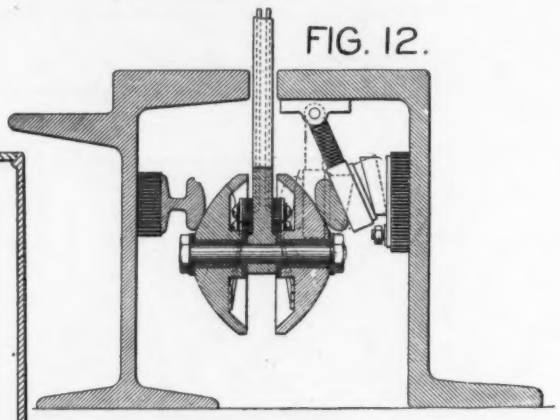


FIG. 12.

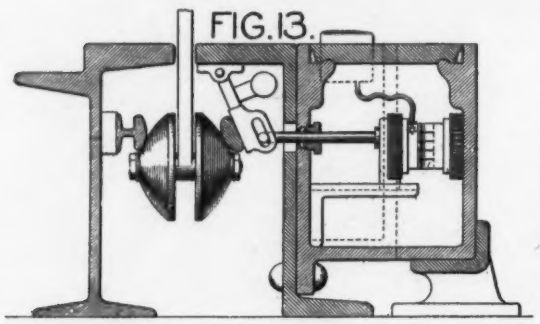


FIG. 13.

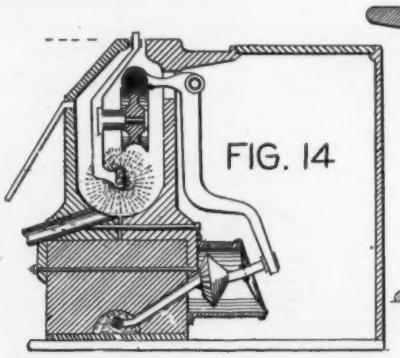


FIG. 14

The specific feature of the device shown in Fig. 15 is to avoid arcing and leakage. The rail or trolley wire, as it might be called, is lifted by the trolley and lowers a contact against a charged conductor. The operation takes place inside a vessel filled with oil, the object of which is to minimize the arcing and to keep the charged conductors free from leakage currents and the effects of moisture. As shown in the diagram the mechanical device is not the preferred design of th inventor, and merely illustrates the principle of oil-protected contacts.

A large class of mechanical connected sectional conductor systems employ stationary third rail or buttons, and make the required connection as the car proceeds through the agency of the car wheels, which depress a pin or rail and moves a system of levers. This principle is well illustrated by Fig. 16. A third rail is placed adjacent to the service rail, and is pressed down by the flange on the car wheel, thus making live two conductors, which are placed in a conduit and are traversed by an appropriate plow as depicted. Gravity and a spring comprise the restoring force. The conduit is not absolutely necessary in such a system as this, for it is obvious that the charged conductors are only those directly under the car and con-

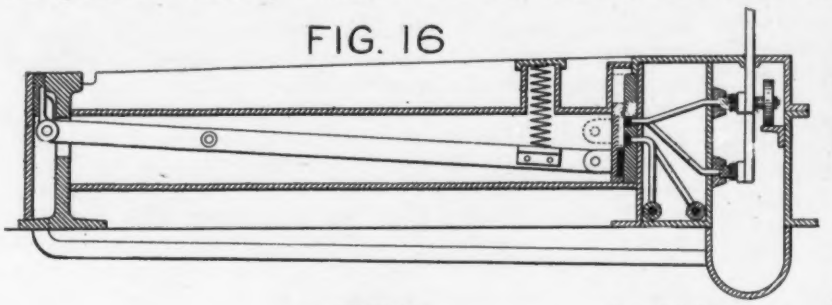
sequently there is no valid objection to placing them on the road-bed. This type can be made one of the most effective of mechanical conductor systems, by making the rail so difficult to depress that any ordinary means will fail and that only the heavily loaded wheels of a motor car can succeed in pressing it down and making contact.

In Fig. 17 is shown another system in which the contacts are made by the revolutions of sections of shafting pivoted longitudinally with the trackway. The forward car wheel flange rides upon a pin, depressing it and thereby turning two ratchet wheels a distance of one notch. The teeth in these ratchet wheels are so arranged that a movement of one tooth will make contact and a similar subsequent movement will break it, the contact being thus made and broken alternately as the ratchet wheel revolves tooth by tooth. The pawl which is operated by the contact pin works in two ratchet wheels. each mounted on its section of shaft, and a movement of this pawl therefore connects the forward section and disconnects the rear one. Thus the system is also an interconnecting one—that is, the same motion charges the section ahead and disconnects the one behind. The operation is obviously as follows: The front car wheel rides upon the pin, depressing it and thereby charging the section in front of the car upon which the contact brush or skate has just impinged. The rear wheels ride upon the pin, throw the ratchet wheel another notch, and cut the section out.

A curious property of this system is that it is impracticable for any truck or train in which the number of wheels on one side is odd to operate on such a track. For instance, if a Robinson radial truck which has three wheels on a side were operated on the track the first wheels would cut in the section as usual, the second or middle pair would cut it out before the car had passed, and the third and last would cut it in again, leaving it live. Thus one trip of such a car would leave all the service conductors charged and curiously enough completely stall the car following, because the phase, if we may use the expression, of the mechanical system would be shifted so that there would always be a dead section under the car, the rest of the track being live. Therefore, in order to restore the track after the passage of a six-wheel car it will be necessary to haul such a car bodily over the track again, for it could not propel itself. An eight-wheel car would experience an odd difficulty also. The section from which it took its current would be cut in, but almost immediately cut out again, and the section in front thereby charged. The car would get no current until the front wheels of the rear truck cut in the section again, and then only for an instant, for the rear wheels would almost immediately cut it out. This simply goes to show that with such a system the length of the car which operates and the wheel base must be a fixed quantity, and that the operator cannot promiscuously patronize other sizes.

Another distinct class of mechanical closure systems, of which the preceding is a representative, is the interdependent system, in which the opening or closing of the circuit of one box is controlled in part by the action of its neighbor. This is illustrated in Fig. 18, which, though thoroughly impractical, illustrates the principle. The trolley wheel strikes two studs in quick succession. The action of the first is to cut out the rear conductor and that of the second to cut in the section over which the wheel is about to travel.

Interdependent connecting systems are largely used in electro-magnetic sectional conductor railways, but mechanical interconnection is difficult to accomplish and is seldom satisfactory. In Figs. 19 and 20 is shown another system, which is an interconnecting one and which is typical of a class. It is operated by a skate the length of the car, which makes contact with pins. These pins, under the action of a spring, tend to fly upwards to a height some three or four inches above the trackway, and are normally pressed down flush with the pavement and securely latched in that position, in which depressed condition they are dead. The act of pressing down a pin unlatches the one next in front by means of switching current into the electro-magnet *k*. The pin, therefore, flies up and becomes charged and must in turn be pressed down, unlatching another in advance, and so proceed ad infinitum. The contact shoe is of such a shape that upon leaving a pin it presses it down and latches it out of contact, thus liberating the one in front, which flies up and makes contact with the other end of the skate. One of the principal objects of this system is to prevent leakage. The cap of the pin only is charged, and when charged is raised some three or four inches above the street level, thus preventing leakage through adjacent snow and slush so long as it is charged. The disadvantages of the system are the use of a spring, and the very unique one that if by any reason a latch should become deranged, permitting its pin to spring up and thereby become charged, it would be impossible to clear the street of it unless the contact box could be opened, for if it were pressed down and latched another one would spring up in the next section, the result being merely a transference of the evil.



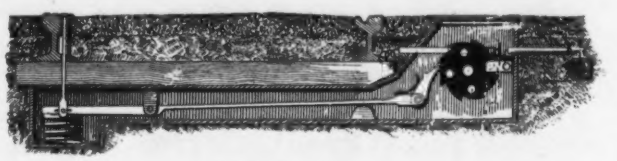


FIG. 17.

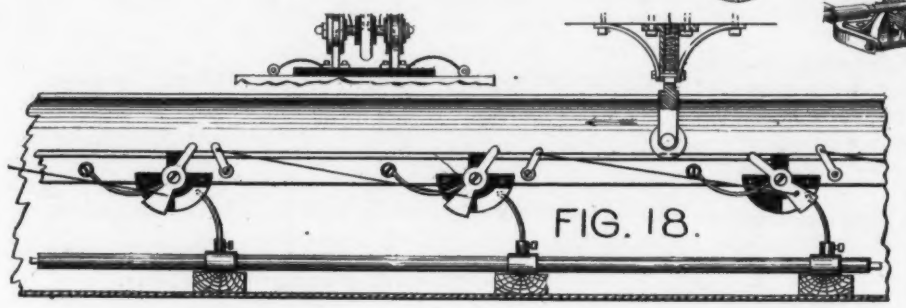


FIG. 18.

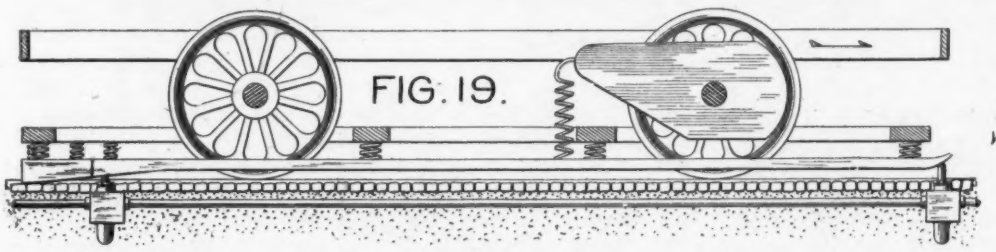
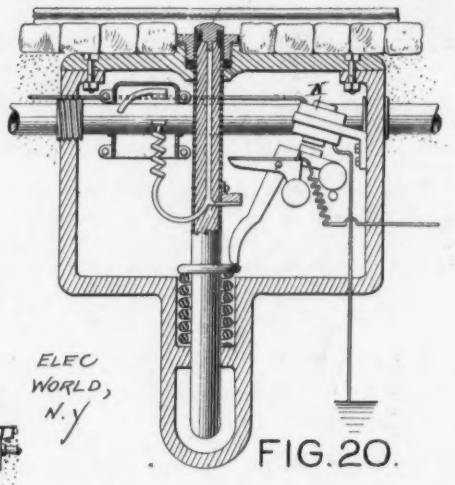


FIG. 19.



ELEC WORLD, N.Y

FIG. 20.

Electric Railways in Japan.

The American Consul at Hiogo, Japan, states that there are three electric railways projected in that consular district, all interurban roads, two of them 15 miles in length each and the other 5 miles long.

Is There Any Such Thing as "Cooling Effect"?

BY ALEXANDER J. WURTS.

The above question is asked with reference to a letter on "A High Tension Switch" by Mr. Chas. Wirt, in The Electrical World, March 19th, 1898, in which Mr. Wirt refers to his patent covering the principle of arc prevention or suppression by means of a series of insulated electrodes. Mr. Wirt then goes on to stat that "the action of arc prevention or suppression due to sub-division in series is probably a mere cooling effect and has been applied to switches in a variety of ways, notably in the case of a recent design of motor controller. The practical suppression of arcing on the break of a high tension current of large volume by this means is something striking."

In studying the action let us, for the sake of clearness, assume a series of ten air gaps between solid metal balls. The question then is, if such balls, say ½ inch in diameter, will just maintain arcs between them with a given current, E. M. F. and size of gap, will these arcs fail to be maintained with balls 2 inches in diameter and equally spaced? The writer thinks that arcs which are maintained in the first case will be maintained in the second, and that arcs which are not maintained in the second case cannot be maintained in the first.

Let us suppose the above arrangement with ½-inch balls to constitute a lightning arrester. The ordinary lightning discharge will not of itself appreciably raise the temperature of the balls, which, at the time of discharge are just as cool as larger balls would be. The air is also equally cool in either case. Now, if a lightning or other static discharge will establish a dynamo circuit over these gaps, and if the arcs are maintained at all, they will be maintained regardless of the size of the balls; because

(1) In either case all the conditions are exactly the same at the start; and,

(2) Having once started the arcs, it is not in the nature of any metal with which we are familiar, no matter what the dimensions may be, to conduct heat away so rapidly that the parts at which arcing is taking place shall be even appreciably cooled, to say nothing of being cooled below the temperature that these parts had at the moment the arcs were started.

For example, if in the accompanying figure the inner circle repre-

sents the smaller ball and the outer circle the larger ball, it will be obvious that if the larger ball can cool out an arc which would otherwise be maintained by the smaller ball the increased cooling effect which the larger ball exercises over the smaller ball would be due to that portion of the larger ball which is shown in section; and further, this increased cooling effect would depend upon the rate at which the heat generated at point *a*, where arcing may be supposed to take place, could be conducted from the point *a* through the portion shown by the smaller ring to the portion of the larger ball shown in section. Now, if an arc is to be cooled out it is obvious that the cooling action must be practically instantaneous, and that during this small interval of time the heat of the arc could not possibly be conducted through any metal more than an almost infinitesimal distance from the point at which the heat is generated. In either case, therefore, whether using the larger or the smaller balls, the temperature of the parts from which arcing occurs will be exactly the same during the small interval of time within which an arc would have to be extinguished by any such action as "cooling effect." The same line of reasoning would hold if it were maintained that a series of small electrodes would cool out a sub-divided arc, which as a single arc might otherwise be maintained between two larger electrodes; for in this case also any cooling action to be effective would have to be so instantaneous that heat conduction and radiation could not enter as a factor.

So far I have endeavored to show that "cooling effect" is an unlikely phenomenon for extinguishing an arc which has once been established.

Arc prevention by means of a series of insulated electrodes is quite another proposition. No one will doubt for a moment that in a lightning arrester an arc may be prevented by this means. The principle, however, seems to be of doubtful value, and it is difficult to imagine how it could be put to a useful service. In a lightning arrester, for example, the number of insulated electrodes which would be necessary to prevent the formation of an arc from ordinary light and power circuits would have to be so great that the device would utterly fail in its other and all-important function of providing a low resistance path for the passage of disruptive discharges.

The trolley-wire-section insulator as designed by Prof. Elihu Thomson is not and never was intended to be an arc-preventing device. It was constructed with several objects in view; one was to provide an unbroken path of travel for the contact wheel, but the object which more particularly concerns us here is the sub-division of the insulator, which, according to Mr. Wirt, causes a "cooling effect" and thereby suppresses the arc on the passage of a trolley wheel. But here again the so-called "cooling effect" does not withstand analysis. The action is really nothing more than the gradual introduction of the resistance and counter E. M. F. of the individual arcs formed in succession as the trolley wheel passes from one section to the other. The device is simply a rheostat with arcs and counter E. M. Fs. for resistances. The current is gradually cut down, but not cooled out.

Perhaps the most instructive and pronounced example of "cooling effect" is to be found in a lightning-arrester recently placed on the market, which, as constructed for 1,000-volt alternating current circuits, consists of a single gap in series with a resistance for each leg of the circuit. The electrodes of the spark gap are two massive brass cylinders placed side by side and separated by $^1/_{32}$ inch. This lightning arrester depends for its action (so the manufacturers claim) on the "cooling effect" of the cylinders, which are said to have great heat-absorbing capacity. The resistance in series with the spark gap is possibly intended to prevent the cooling cylinders from being overworked.

This device has been tested by the writer on a 1000-volt alternating current circuit, and it was found, to the great amusement of some by-standers who happened to be watching the experiments, that the large brass cylinders could be replaced with ordinary toilet pins without in the least affecting the results. The arc was repeatedly established in the ordinary way with a static machine, without noticeable damage to the pin points and without maintaining the arc. Perhaps it was the resistance in series with the gap which cooled out the arc.

A Continuous Integrating Indicator.

An instrument for giving a record of the aggregate number of hp hours developed in the cylinder of a steam engine is described in a recent issue of London "Engineering." This instrument is similar to the ordinary indicator, but no paper is used on the oscillating drum, whose motion is, as in the ordinary indicator, proportional to that of the crosshead. Against this drum bears a wheel, the inclination of the plane of which to the axis of the drum is varied by the steam pressure in the indicator cylinder in such a way that the wheel is turned by the drum at a rate proportional to the pressure. The wheel turns forward on the outward stroke of the crosshead and backward a smaller amount on the return stroke, thus giving at each revolution of the engine a resultant forward motion proportional to the mean effective pressure. This is added on a counting train, so that by setting the instrument in action and allowing it to work for any given length of time the aggregate number of hp hours developed in that time is indicated direct without any bother with planimeters or calculation. This amount divided by the time during which the instrument was in operation gives the average horsepower.

Electric Light and Railroads in Moscow.

The city of Moscow, Russia, has contracted with Messers. Siemens & Halske to construct six lines of electric street railway in the city, and also to take charge of the electric lighting system now installed. The contract involves the payment of $3,000,000 from time to time out of the profits of the tramway system, the contractors to be paid for the lighting at a rate equal to the cost of the kerosene lighting used hitherto.

Interurban Electric Roads in Germany.

The South German Railroad Company proposes to establish trolley roads between Wiesbaden, Mainz, Kastel, Amöneburg, Biebrich and Schierstein and Eltville.

The Cost of Niagara Power in Buffalo.

The Cataract Power & Conduit Company, of Buffalo, has lately presented a statement of the rates of charges for electric power which it has adopted, with the reasons for the various details of the schedules, the whole forming a valuable contribution on the subject of the cost of power. From this statement the following sentences are taken:

The establishment of a system of charges which shall favor no one class of users of power at the expense of others has proved to be a matter of considerable difficulty in view of the great variety of service required. It is probable that in no other city is power used in a greater variety of ways than in Buffalo. There are, on the one hand, the electric railways and lighting companies, flour mills and factories requiring hundreds or thousands of horse-power, and, on the other hand, a very large number of manufacturing and other establishments using power only in very small amounts.

Again, as regards plants of all sizes within these limits, it is necessary to take into account the fact that while some require power continuously during twenty-four hours per day others use power intermittently, in some cases averaging only two or three hours per day. As a result of the wide range in the amounts of power which must be kept available for various users and of the radical differences in hours of use, neither the so-called flat-rate system of charges, under which each user is charged a certain amount per horse-power kept at his disposal, nor the ordinary method of charging by meter, under which each user pays a certain amount fixed by schedule for the actual number of kw hours or hp hours used, as recorded by meter, can be adopted without imposing upon one or more classes of users of power charges which are relatively excessive.

We have been able to devise no practicable system of charging simply by meter because of the fact that if the charge per hp hour be so adjusted as to yield the proper and necessary revenue in the case of the customer using power continuously, it will not yield sufficient revenue to cover the actual cost of the power in the case of the customer who uses the power only a few hours per day.

It is evidently proper and also necessary that the charges per horse-power should be somewhat greater in the case of customers using small amounts of power than in case of customers using relatively large amounts of power. This difference, however, we have made only sufficient to cover the relatively greater cost of connections, general expenses, etc., which must be borne by the Power Company, and we have so arranged our schedules that, as compared with the schedules used by other companies selling electric power in other large cities, they are extremely favorable to the users of small amounts of power.

In determining our charges we have aimed to make them so low that even the most perfect modern steam plant will find it advantageous to substitute Niagara power. The practical result of this will, of course, be a very marked saving in the case of the ordinary plant using steam power.

The rates which we have fixed are for Niagara power as distributed from our sub-stations. This is supplied in the form of three-phase alternating current, and we are now prepared to deliver it to all points within distances which can be conveniently reached from our sub-stations. These sub-stations are: No. 1, located adjoining the power house of the Buffalo Railway Company, on Niagara street, and No. 2, on Ohio Street, near Indiana Street. The transforming machinery for sub-station No. 3, which will be located on Wilkinson Street, is now under construction and will soon be in place ready to supply power. Other sub-stations will be established from time to time at such points as may be necessary.

All payments for power are to be made monthly and the amount of each monthly payment will consist of a charge for service, and, in addition thereto, a charge for power. The charge for service is $1 per kilowatt per month, and this charge will depend only upon the amount of power which the user may require the Cataract Power & Conduit Company to keep available and ready for his use.

The monthly charge for power will depend upon the aggregate amount used, as determined by integrating meters installed by the Conduit Company upon the premises of the consumer. The charge for power will be determined from the following schedule:

For use not exceeding 1000 units, or kw hours per month, the rate shall be 2 cents per unit.

For use exceeding 1000 units, but not exceeding 2000 units, the rate shall be: For 1000 units 2 cents per unit, and for the excess 1 5-10 cents per unit.

For use exceeding 2000 units, but not exceeding 3000 units, the rate shall be: For 2000 units 1 5-10 cents per unit, and for the excess 1 2-10 cents per unit.

For use exceeding 3000 units, but not exceeding 5000 units, the rate shall be: For 3000 units 1 2-10 cents per unit, and for the excess 1 cent per unit.

For use exceeding 5000 units, but not exceeding 10,000 units, the rate shall be: For 5000 units 1 cent per unit, and for the excess eight-tenths of a cent per unit.

For use exceeding 10,000 units, but not exceeding 20,000 units, the rate shall be: For 10,000 units eight-tenths of a cent per unit, and for the excess, seventy-five hundredths of a cent per unit.

For use exceeding 20,000 units, but not exceeding 40,000 units, the rate shall be: For 20,000 units seventy-five hundredths of a cent per unit, and for the excess seven-tenths of a cent per unit.

For use exceeding 40,000 units, but not exceeding 80,000 units, the rate shall be: For 40,000 units seven-tenths of a cent per unit, and for the excess sixty-six hundredths of a cent per unit.

For use exceeding 80,000 units the rate shall be: For 80,000 units sixty-six hundredths of a cent per unit, and for the excess sixty-four hundredths of a cent per unit.

Notes on the Preparations for War.

The following are some interesting notes concerning the electrical features of the Government's hasty preparation for war. They are taken from the daily press, and owing to the attempts of those concerned to avoid publicity they cannot always be verified. Those which can, however, will be so stated.

DYNAMOS FOR SHIPS AND FORTS.

It is stated that the Westinghouse Electric & Manufacturing Company has received Government orders for $700,000 worth of generators, motors, etc., for use in light and power plants on vessels and fortifications now being equipped for the Government service. A bonus of $25,000 has been promised for prompt delivery.

A RUSH ORDER FOR LAMPS.

The lamp department of the General Electric Company at Harrison, N. J., has received an order from the Navy Department to ship as rapidly as possible 25,000 incandescent lamps for use on the ships of the navy. A large portion of the shipment is to go direct to Key West for use of the fleet there. The order was received on the morning of Thursday, the 14th, and before the works closed for the night the entire order had been filled and delivered to the Pennsylvania Railroad Company for shipment.

COAST SIGNAL STATIONS.

A special appropriation of $200,000 has been made for the establishment of signal stations at prominent points along the coast. These will be interconnected by overland telegraph lines, and will also be connected with the main telegraph systems inland. The stations will be spaced between 50 and 100 miles apart. A call for volunteer telegraph operators was issued on April 16, several men responding at once and others being expected later. These men will be enlisted and treated as soldiers, although on account of their necessary skill they will be rated somewhat higher than privates and given better compensation. This is said to be $35 a month and "found."

NIGHT SIGNALING ON SHIPBOARD.

The Navy Department has decided to abandon the use of the Ardois system of night signals and equip the ships of the navy, and also the coast fortifications, with the instrument known as the telephotos, rush orders for a considerable number of equipments having been placed with the Boughton Telephotos Company of Buffalo, N. Y. The instrument consists of four lanterns strung in a vertical line in the rigging, about 10 to 14 feet apart. Each lantern is divided into two compartments, one above the other, each compartment containing several incandescent lamps and covered with a barrel lens for concentrating the light in a horizontal plane. One of these lenses is red and the other is clear. The system is worked on the Morse code, the signals being read downwards, a white light signifying a dot and a red light a dash. The circuits of the lamps are controlled from a keyboard, the keys being suitably provided with contacts such that the depression of any key closes the proper circuits for a representation, as described above, of the letter. The keys are interlocking, so that no two can be pressed simultaneously and any one can be latched down so that the signals can be left burning on a standing order.

Notes from the Colleges.

UNIVERSITY OF CALIFORNIA.

A complete central station for the distribution of light and power for the various buildings and departments of the university has been installed.

MISSISSIPPI AGRICULTURAL AND MECHANICAL COLLEGE.

The installation of a complete college lighting and power plant, to be used also for electrical laboratory experimentation, will soon be undertaken.

LEHIGH UNIVERSITY.

Prof. W. S. Franklin, late of the Iowa State Agricultural College, has been appointed as head of the Department of Physics and Electrical Engineering, in the place of Professor Harding, who has retired.

STATE COLLEGE OF KENTUCKY.

A marble switchboard of modern design, having outlets for 110 circuits, has been built for the Electrical Laboratory, all the electrical work being done by the students of the college. It is divided into three panels, each 3 feet x 4 feet, supported in an ornamental cherry frame. The students have also wired up the new science building for 200 incandescent lights and rewired the shops and laboratories.

UNIVERSITY OF MICHIGAN.

Students last year constructed for the Laboratory of Electrical Engineering of the University of Michigan an alternating current generator for one, two or three-phase currents. The machine is driven by a direct-current motor and has proved to be entirely satisfactory and very useful. This year other students have designed and made four transformers, two of them to step up from 100 to 1000 volts and to convert from two phase to three phase. The other pair convert back again to two-phase currents and step down to 100 volts.

PURDUE UNIVERSITY.

The students of the Electrical Engineering Department of Purdue University, Lafayette, Ind., are to be especially favored this spring in the matter of visiting electricians who will address them along professional lines. Prominent among the list of the non-resident lecturers at the university are the names of Mr. Samuel Insull and Mr. Albion E. Lang. Mr. Lang, who is president of the Toledo Traction Company and of the American Street Railway Association, will deliver an address at the university on the subject of "Electric Power Companies and Their Relation to Municipalities," on the 26th of this month. Mr. Insull is at the head of the Chicago Edison Company and is president of the National Electric Light Association. He will visit the university on May 17 and will lecture on the subject of "The Development of the Central Station."

An Electric Transmission Plant in North Carolina.

BY HARRIE STORM

The Fries Manufacturing & Power Company is constructing a long distance electric transmission plant from the Yadkin River to the twin cities, Winston-Salem, N. C. The conditions are rather peculiar, in some respects. The river is frequently swollen by rains to several times its normal volume, and the banks and lands above the power house are so low as to render a dam high enough to moderate the flow entirely out of the question. On that account the dam is only 10 feet high, with practically no storage for water. Measurements taken last summer, however, when the river was as low as it has ever been known to be, showed some 230 horse-power per foot fall. The average power of the plant will be some 2500 to 2700 horse-power.

Everything has been built with due regard to avoiding damage from this high water. The wheel house is about 140 x 40 feet, and projects into the river its whole length. It is divided into eight wheel pits, in each of which is at present a 54-inch vertical McCormick turbine (made by S. Morgan Smith Company, York, Pa.), with provision for another one of possibly larger size. These wheels are set on a double 3-inch pine flooring, on steel I beam frames, 8 feet below head-water. Each compartment is arched below, and the draught tubes from the wheels reach into the tail water, 2 feet below the floor. The vertical shafts rise 25 or 30 feet, and by crown gear transmit their power to a horizontal shaft, which is connected direct to the generator, a 750-kw three-phase S. K. C. alternator, made by the Stanley Electric Manufacturing Company, of Pittsfield, Mass.

The wheel house is of rubble masonry for about 18 feet; and the division walls between the pits are continued for about 12 feet with brick, being left open below to allow high water an outlet, and finally there is a frame building about 10 feet high for the crown gear and governors, the Lombard water wheel governors being used, one for each four wheels. The generator foundations and dam are also of rubble masonry, and, like the wheel house, go down to solid bed rock.

The power is transmitted to Winston-Salem (13½ miles) on three No. 1 copper wires, at 10,000 volts pressure. The line is built, as are the wheel and generator houses, with provision for another large unit and circuit. The top cross arm on the main line carries the telephone wire and two barbed lightning protection wires, which are frequently grounded.

In the town a sub-station contains the transformers, which reduce the potential to 1200 volts, for distribution to points within a mile. For points further than that, the current is sent at 10,000 volts, and a local sub-station established. The furthest point of the system from the distributing station is 3½ miles. The company expects within a short time to put in another 750-kw or 1000-kw generator. The officers are as follows:

President, H. W. Fries; vice-president, C. H. Fogle; treasurer, J. W. Fries; general manager, H. E. Fries. The engineers are C. R. Makepeace, and, for the electric work, George E. Claflin, both of Providence, R. I.

A High-Tension Switch.

To the Editor of The Electrical World:

Sir:—In connection with a description of the Mueller high-tension switch in your issue of March 5, 1898, also subsequent letters by Mr. Charles Wirt, March 19, and Prof. Elihu Thomson, April 2, and in justice to Mr. Mueller, I wish to say that Mr. Mueller's claims for novelty do not seem to be as broad as one would be led to suppose by the references to Wirt and Thomson patents Nos. 414,356 and 500,629 respectively, and further, the important and fundamental principle involved is not arc sub-division, but one depending on the non-arcing property of the electrodes.

Perhaps the following extract from Mr. Mueller's patent specification will clear away any misunderstanding in this matter. I will simply add that the italics are mine and are intended to call attention to the specific object aimed at by Mr. Mueller:

"This invention relates to certain improvements in high-tension switches, in which the oxidation of the contacting parts and the consequent objectionable insulation of these parts can be to a great extent prevented and neutralized and a high-tension switch of superior properties and durability is obtained.

"It has been found in lightning protectors that the passage of a spark of a high-tension current can be readily prevented when two conditions are present as follows: First, when the contacting parts by which the circuit is closed are formed of an easily oxidizing metal and the oxide of which is a good non-conductor of electricity—that is to say, composed of non-arcing metal; second, when the distance between the contacting parts is very small, as when the distance between the contacting parts is large, in consequence of the greater heating and the consequent evaporation of the metal, an arc may be formed as described by Wurts in his papers. It was therefore proposed to form the contacting parts of balls or rollers arranged in a row, so that when these balls or rollers are pressed together the circuit is closed, while the circuit is interrupted by separating the balls or rollers or by the formation of small spaces between the contacting parts when the pressure on the parts is removed. The small sparks which are formed on the separation of the contacting parts are, in consequence of the oxide, quickly extinguished, as before described. The insulating property of the resulting oxide, however, has the disadvantage that after a comparatively short use of such a switch the circuit cannot be entirely and reliably closed.

"The object of my invention, therefore, is *to obviate these objections* and to provide a switch for high-tension currents in which the *objectionable interference of the oxidation of the contacting parts is avoided;* and the invention consists of a high-tension switch composed of a series of roller-shaped contact pieces arranged in a row, which are made of easily oxidizing *non-arcing metal* and of a mechanism by which the said rollers may be either pressed together or separated from each other in such a manner that by the closing and opening, respectively, of the circuit a *turning motion is imparted to said contact pieces*, as will be fully described hereinafter, and finally pointed out in the claims."

Alex. Jay Wurts.

Pittsburg, Pa.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE
AMERICAN AND FOREIGN
By Carl Hering

Dynamos, Motors and Transformers.

ELECTRIC GENERATORS. Parshall and Hobart. Lond. "Engineering," April 1.—In this continuation of their series they discuss the formula for E. M. F. of dynamos and transformers. For continuous current dynamos they give as the most convenient formula $V = 4.00\ T\ N\ M$ multiplied by 10 to the minus eight power, in which V is the voltage, T the number of turns in series with the brushes, N the number of magnetic cycles per second and M the magnetic flux in C. G. S. lines included by each of the T turns in a magnetic cycle. This formula is applicable if correctly interpreted, to a ring, drum, or disc armature. This is followed by some explanations regarding the correct interpretation; N is usually confined to alternating current work, but they claim it is desirable to use it also for continuous currents. For an alternator they use the same formula, except that the first constant is 4.44, but this is based on a sine curve. For transformers the formula is the same as the first except that an additional factor f is introduced called the "form factor," proposed by Fleming, and which is equal to the ratio of the square root of the mean of the squares of the equi-spaced ordinates of the curve to the true mean value of the equi-spaced ordinates; this corrects it for the wave form.

UNINSULATED ARMATURE BOLTS. Fischer-Hinnen. "L'Ind. Elec.," Mar. 25.—It is generally supposed that if the ends of the bolts passing through the armature discs are not insulated the loss of energy in the armature will be increased. In the present article he calculates what these losses would be if the bolts are not insulated, and obtains an expression from which this current could be determined; applying this as an example to a 180-kw machine, he finds that the loss thus calculated in the six bolts would be only 5.3 watts, showing that in such a machine it is absolutely unnecessary to insulate the bolts.

COMPENSATION WINDINGS. Menges. "Elek. Zeit.," Mar. 31.—A long communication discussing the question of compensation windings and the reduction of the sparking, with special reference to his own methods in connection with an open circuit machine. He claims that in general the question of compensation windings is not correctly understood.

OPERATION OF MULTIPHASE CURRENTS. Hawkins. Lond. "Elec. Rev.," April 1.—A continuation of the reprint of his paper (see "Digest" last week). A reprint is also given in the Lond. "Elec. Eng.," Mar. 25 and April 1.

ALTERNATING CURRENT MOTORS. Tasker. Lond. "Elec. Eng.," April 1.—The beginning of a reprint of a long paper read at a students' meeting of the Institution; it contains many illustrations, and seems to be of an elementary character.

THREE PHASE MACHINERY. Venable. "West. Elec.," April 9.—A short, profusely illustrated article of an elementary character describing three phase currents and machinery.

ARMATURE WINDINGS AND CONNECTIONS. Rice. "Amer. Elec.," April. Multipolar windings and two circuit connections form the subject of the present installment of this series.

DESIGN OF SLOW-SPEED MOTORS. Dunn. "Elec. Eng.," April 14.—In this installment of his series he discusses the details and the regulation and controlling apparatus.

WORKSHOP HINTS. Hobart. "Amer. Elec.," April.—A home-made mandrel press is described for punching armature discs.

Lights and Lighting.

NICKEL IRON ALLOY LEADING-IN WIRES.—"Elek. Anz.," March 27.—A note stating that Froelich reported on some iron alloys made by a French company, the results of which have shown that by altering the proportion of these metals in the alloy very different temperature coefficients are obtained; an alloy of 40 per cent. nickel has the same coefficient of expansion as platinum. Samples of this alloy were tested by the German Reichsanstalt and the results were completely confirmed.

NERNST LAMP.—"L'Ind. Elec.," March 25.—A note on this lamp calling attention to the fact that twenty years ago Jablochkoff used plates of kaolin brought to incandescence by alternating currents, but at that time no measurements of the light intensity or electric energy were made.

ELECTRICAL DECORATIONS. Persons. "Amer. Elec.," April.—A description of a switch for producing the effect of a waving flag by a combination of incandescent lamps.

ELECTRICAL SIGN SWITCHING. Hanchett. "Amer. Elec.," April.—Description of types of mercury switches for use in connection with electric signs.

Power.

100-MILE TRANSMISSION SCHEME.—Lond. "Elec.," April 1.—A note from a German daily paper, stating that a scheme has been worked out in Stockholm for the use of a part of the 100,000 horse-power of the water fall of Elfkarleby, 100 miles from that city. It is proposed to utilize at present at least 20,000 horse-power at a total cost of $2,200,000; the loss in transmission is to be 5000 horse-power; the power to be sold at about $11 per horse-power per year.

POWER SUPPLY FROM CENTRAL STATIONS. Addenbrooke. Lond. "Elec. Rev.," April 1.—A reply to the criticisms of his recent paper noticed in the "Digest," last week.

SPEED REGULATOR OF TURBINES. Rieter system. "Elek. Anz.," March 27.—A German translation of the article noticed in the "Digest," April 2.

DOLGEVILLE WATER-POWER PLANT. Grissinger. "Amer. Elec.," April.—A description by the constructing electrical engineer of the new water-power plant at Dolgeville, N. Y., which displaces one of the first electrical plants installed in this country. There are two 450-kw two-phase generators direct connected to horizontal twin turbines, the speed being 483 r. p. m. A part of the power will be delivered at Little Falls, 8 miles distant, at a voltage of 10,000.

ELECTRICITY FOR TURNING LOCOMOTIVES AND CARS. Rawn. "Amer. Elec.," April.—A description of electrical means adopted for the working of railroad turn tables. During the past four months the cost of electric power, which is taken from a lighting company at meter rates, was $29, while it would have cost $73 to operate the same turn table by hand, the saving in four months thus being $709 for a single case.

ELECTRIC FAN MOTORS.—"Amer. Elec.," April.—A description, with thirty-four illustrations, of 1898 models of direct and alternating current fan motors.

Traction.

ACCUMULATOR TRACTION. Hauswald. "Elek. Zeit.," March 31.—A reprint of a long paper, with the discussion, read before the German Electrical Society. It consists mainly of a description and a discussion of the Pollak system in use at Frankford, o. M.; it includes also some general deductions concerning traction accumulators. In these accumulators the active material is first changed by means of a chemical method into extremely fine porous metallic lead and after that it is formed; the construction is the same for the positive as for the negative plates; the normal capacity of certain cells may be taken as 1-kw hour per 100 kg (whether plates or complete batteries is not stated) at a three-hour discharge; the price of 100 kg is about $50 to $60. The results of his investigations led him to two laws, the first that a given plate will stand higher current strength only when the discharge is a fraction of the normal capacity; also that the higher the efficiency at a given discharge the greater will be the life. The requirements to withstand vibrations are enumerated; he claims that it is necessary to wash out all of the cells at regular periods. The requirements for a traction battery are then enumerated; the weight of a normal car alone is 6 tons, the mean load 1 ton and the speed 9 miles per hour, with a mean daily run of 78 miles. The current consumption per ton kilometer with the overhead trolley system was found to be 60 watt hours, but this is said to be very high, and that with this, calculations show it to be hardly possible to use accumulators for a full day's run. With accumulators the energy per ton km was reduced to 30 or 40 watts. He then makes some calculations based on the various losses and coefficients, and finds that 25 watt hours per ton kilometer would be required; this shows how small, theoretically, the amount of power is; the losses may be still further reduced; tests made with one of their cars gave 33 watt hours; he concludes that for a well-designed system 30 to 40 watt hours per ton km may be used as a basis for accumulator traction, or on long, level stretches 20 watt hours. By using roller bearings a further saving of 10 per cent. of the total energy was obtained. He then discusses the ways in which accumulator traction brings about a saving of energy; among these are a very economical system of regulating the current by connecting the two halves of the battery in parallel for starting and slow speed; regarding the wear of the rails he states that it has been shown that for moderate weights of accumulators the wear is not great, which is explained by the fact that the wear does not depend only on the number of ton kilometers, but also on the mean traction coefficient, which latter is favorable to accumulator traction. The cost and weight of the battery, as well as other considerations, are against the system of supplying energy for a day's run; but he favors the system of rapid charging at frequent intervals, thus only partially discharging the accumulators, which is accompanied by a high efficiency; the current from the central station will in that case be small, the life of the batteries great, and there will be considerable reserve energy in the batteries; the results obtained by the use of this system have been very satisfactory. He then describes the plant in Frankford. The charging is quite automatic; the length of the line is about 1 mile; the weight of the car with batteries but no passengers is 8 tons; it will carry 42 passengers, and has one 15-hp motor for a speed of 9 miles. There are 84 cells of batteries; the charging is at constant potential, which is so chosen that the batteries can never gas; the current consumption per car kilometer, including the loss in the battery and leads, was 400

watt hours per car kilometer, the efficiency of the batteries being 85 per cent.; every week the separate cells are tested and are charged up to 2.5 volts; the charging current may be quite great and per kilometer run the charging time is 1.5 to 2 minutes. This system of partial charges cannot be used for long stretches, and for this the mixed trolley and accumulator system is considered best, but in this great care must be taken to get the proper relation between the distances run by the accumulators and by the overhead line; the regulation of the charging should be automatic, and great care should be taken that the batteries do not gas. A calculation is then made to show the energy consumed for the overhead and for the mixed systems, and he obtains 2100 and 2480 as the watt hours in the two cases in an example; in comparison with the conduit system he claims that the mixed accumulator and trolley system is at present already the better, and above all it is more reliable. In conclusion he discusses briefly the application of accumulators on steam railroad lines, and concludes that it is practicable only for distances below 40 miles with one charge, and it is therefore practical only for suburban lines. In the discussion which followed, Hopfelt thought the first of the laws regarding accumulators is applicable only to those of the Faure type, and not to the Planté type; there is also a third law—namely, that the life can be determined from the reduction of the capacity with increasing discharging currents. He gives a method of rapidly determining the traction coefficient, which consists in cutting off the current and allowing the car to drift, but the speed must be so low that the air resistance has no effect; the time and distance are then measured from a certain point until the car comes to rest; the traction coefficient will then be equal to this distance divided by 5 times the square of this time (he probably means that the result is in kilograms per ton); the average results found in this way were 5, although figures as low as 2 were obtained. Moreover an increase of 25 per cent. in the weight of a car increase the current required only about 6 per cent. Kapp remarked that the method described above for measuring the traction coefficient in general gives small values, which he believes is due to the fact that the motors tend to keep the car moving, and that, therefore, the car travels much easier than under normal running conditions when all the working parts are under strain. He states having made a test of that line and found that only 330 watt hours passed through the switchboard at the power station per car km, a result which he considers to be exceptionally good.

ACCUMULATOR TRACTION.—"L'Ind. Elec.," March 25.—Some notes on the experiments in Rome, where the Pescetto accumulator is used. The car, which was one made for a trolley line, weighed 8300 kg and the batteries 2000 kg; the re-charging was accomplished in a "few" minutes, depending on the requirements; two controllers were used, so that the car could be run either from the trolley or from the accumulators; the line is about 3 km in length; the results were so successful that other lines will soon be transformed.

SPAN AND SAG OF TROLLEY WIRES. Siller. Lond. "Elec. Rev.," April 1.—A short article, describing a convenient way of finding the proper dip which must be allowed in stringing trolley wires so as to avoid overstraining the wire during the lowest temperature of the season. This is done by means of the accompanying diagram, which is based on the following: That the tensile strain is equal to 25 tons per sq. in.; that the safe working strain is one-quarter of this; that the elongation is 0.0018 times between the freezing and the boiling points of water or 0.0001 times for each 10° Fahr. rise; that the dip varies as the square of the span, which is sufficiently correct for this purpose. For a given span and strain per sq. in. the dip will be the same for all sections of the same material. The curve in the diagram gives the rate of increase of dip for a copper wire, which was determined experimentally by securing the wire at one end and passing the other over a pulley 100 ft. distant, loading this end with the proper weight; the dip was then measured and taken to be the minimum at 0° Fahr.; the length of the wire between the supports was then increased by amounts corresponding to successive increases of temperature of 10° Fahr., the dip being measured for each case; zero and 130° Fahr. were assumed to be the limiting temperatures for that country. The diagonals represent the spans; thus if the dip for any one span is known, that for any other can be read off. To use the diagram begin at the temperature scale, follow to the curve, then to the diagonal and then to the dip, as shown in an example by the dotted line, which is for 75° and a span of 140 ft., the required dip being then 18.4 inches.

RAILWAY STATISTICS FOR EUROPE.—"Elek. Zeit.," March 31.—A reprint of the concluding tables of summaries noticed in the "Digest," April 9.

SURFACE CONTACT SYSTEM.—"Elec. Eng.," April 14.—A brief illustrated description of the Brown system, which is in use experimentally on a short stretch in Washington. Every 8 ft. there is a fixed iron contact plate between the rails under which is a porcelain cup containing mercury in which a steel ball floats; the car carries magnets which attract the steel balls through the iron plate, thus bringing them in contact with the latter while the car is passing over them. It appears that the porcelain cups break by the jolting of the balls, thus causing leakage currents.

ELECTRIC RAILWAY PRACTICE. Parham. "Amer. Elec.," April.—The principles of car wiring are considered and methods are given for determining when the circuits are properly installed on a car.

Installations, Systems and Appliances.

COST OF GENERATING AND DISTRIBUTING ELECTRICAL ENERGY. Hammond. Lond. "Elec.," April 1.—The beginning of a long abstract of an Institution paper. It consists of an analysis of the Board of Trade returns as far as the costs are concerned, and is limited to the larger stations in the United Kingdom; it covers the period from 1890 to 1896 and in some cases to 1897; it does not include the power stations for railways, as these are not required by law to make returns; much of the data and a number of curves are reprinted. The total costs per unit sold for the following stations for 1896 or 1897 were: Kensington, 5.32 cents; Westminster, 4.38 cents; Manchester, 2.90 cents; Leeds, 3.0 cents; Edinburgh, 2.26 cents. With only two exceptions the costs show a decrease compared with those of the preceding year; if the most favorable features in each of the works could be reproduced in one single station, electric energy for lighting could be produced and distributed for 1.68 cents. Crompton, in his paper read in 1894, prophesied the costs for a station, having an output of 5,000,000 units, and these items are reproduced, the total being 2.64 cents; these ideal figures have therefore in one case been improved upon and closely approached by others with a much lower output, but the coal in these was obtained below $5 per ton, which was the basis of Crompton's estimate and which referred chiefly to London; the actual costs in two stations was 4.38; those for a number of provincial works are also given and average about 3 cents. He shows that the low cost is the result of a combination of favorable conditions; the total output is the greatest factor, and he illustrates this with a set of curves showing the relation between the cost and the units sold; the load factor is the next important factor; by this term he means the ratio of the actual units generated to the product of the maximum of the year and the total hours of the year. A diagram shows the relation between the load factor and the cost per unit for a large number of different stations; generally when the cost is low, the load factor is almost always high; the load factors vary from 6.16 per cent. to 24.62 per cent.; in a hypothetical case he shows a reduction from 5 to 2 cents a unit, by means of a considerable increase in the load factor. The load factor as usually calculated does not represent the percentage use of the plant, partly because in most stations there is a gradual increase throughout the year, so that the maximum demand at the end is appreciably higher than at the beginning; the more correct way is to average the two maximum demands at the beginning and end, and use this as the basis; this correction is made in a number of cases, and the difference is quite appreciable. Another method is sometimes suggested as still more reliable, namely, "the comparison of the ratio of the number of units sold to the product of the total of the maximum demands of the consumers into the hours of the year," but the data cannot always be obtained; he gives in a diagram for a large number of stations the relation between the units sold per year per lamp fixed, averaged over the year and the price per unit. The paper is referred to editorially in the former journal; it is suggested that it would have been more correct to have compared the costs with the units generated instead of those sold; it is thought that his contention is not quite sound when he places the output as a more important factor than the load factor. He takes no notice whatever of the capital, utterly ignoring its influence on the annual costs and the relative merits of the different systems, and this is thought to be the most serious defect of the paper; with a large capital outlay and standing charges, satisfactory results can only be obtained with a high load factor, no matter what the output; to ignore the influence of capital is to leave out of consideration the prime factor in determining the relative importance of the load factor and the total output, thus arriving at conclusions which may be diametrically opposite to the truth.

The Lond. "Elec. Rev.," April 1, begins an abstract without illustrations, and gives a brief summary of the discussion; a brief summary is also given in the Lond. "Elec. Eng.," March 25. The discussion is given in the Lond. "Elec. Eng.," April 1.

CENTRAL STATION ACCOUNTS.—Lond. "Elec.," April 1.—An analysis of the accounts of the Oxford and Scarborough stations and of the Bristol Railway Company.

BANKING DISSIMILAR TRANSFORMERS. Lond. "Elec. Eng.," April 1.—Answers to the question at what point it is best to parallel different types of transformers which do not parallel correctly at all loads.

PARALLELING ALTERNATORS.—Lond. "Elec. Eng.," April 1.—Requests for a description of the best apparatus to use when they are in synchronism.

PARIS. Soulier. "L'Ind. Elec.," March 25.—The first part of a long illustrated description of the new station on the Quai de Jemmapes (see also "Digest," April 9).

TORQUAY.—Lond. "Elec. Rev.," April 1.—An illustrated description of this municipal plant. A brief illustrated description is also given in the Lond "Elec. Eng.," March 25 (see also "Digest," April 9).

STATISTICS ON ENGLISH LIGHTING PLANTS. D'Oyly. "Elec. Eng.," April 14.—The beginning of an article in which he endeavors to show some of the effects of the expenditures in foreign stations, on the operating expenses and net and gross earnings, as compared with results in this country; in those English stations more money and energy is expended for making the work more permanent, and with less deterioriation.

Wires, Wiring and Conduits.

FLEXIBLE CORD FOR 200 VOLTS. Wardrop. Lond. "Elec.," April 1.—A note stating that he recently wired two installations for 200 volts in which a large amount of flexible cord was

used; it has vulcanized rubber insulation and stood every test, both mechanical and electrical; it has given no trouble since it was in use.

HIGH TENSION AERIAL LINES. "L'Elec.," April 2.—A long article giving illustrated descriptions of numerous forms of porcelain insulators for high tension lines, made by a French firm.

COPPER FOR THREE-PHASE TRANSMISSION. Lond. "Elec. Eng.," Mar. 25.—Answers to a request to compare the weight of copper required for a certain direct current transmission plant and for the three-phase current system.

LIVE WIRES. Herbert. "Amer. Elec.," April.—In answer to a criticism that certain double-ended switches are objectionable on account of involving live wires when the light is off, it is pointed out that, in the first place, the same objection applies to all such switches; and, in the second place, there is no reason why they should be condemned by the underwriters, as the same condition is met elsewhere.

DIAGRAMS OF ELECTRICAL CONNECTIONS. "Amer. Elec.," April.—The current number of this supplement contains diagrammatic plans of isolated plant direct-current switchboards, equalizing systems and single-phase alternating and distributing systems.

A COME-ALONG KINK. "Amer. Elec.," April.—An improvised come-along made by taking four half-hitches on a wire with a rope, the rope then being run around a No. 1 porcelain insulator, through a hole in which a link of No. 4 wire passes, the tackle being made fast to the latter.

INTERIOR WIRING. Knox. "Amer. Elec., April.—The present installment of this series deals with branch circuits.

Electro-Physics and Magnetism.

CIRCULATION OF GASEOUS MATTER IN A CROOKES TUBE. Swinton. Lond. "Elec., "Elec. Rev." and "Elec. Eng.," April 1.—An abstract of a Physical Society paper. He investigated the stream lines by the direction and speed of rotation of a mica radiometer mill mounted on a sliding rod so that it could be moved along a line at right angles to that joining the electrodes. A point was reached when the rotation ceased, and beyond this it was reversed. It seems to establish the existence at high degrees of exhaustion, of a true stream which travels from the anode to the cathode quite similar to the cathode stream. At very high vacua, with a large free path, there may be a complete circulation of positive and negative atoms passing from the anode to the cathode and vice versa, delivering up their charges by direct convexion. The discussion is given briefly: Appleyard suggested having the veins of the mill of some light-conducting substance which does not retain the charges, as this would give simpler results.

LUMINESCENCE BY ROENTGEN RAYS. Roiti. "Rendic dei Lincei," Feb. 20; abstracted with the illustration in the Lond. "Elec." April 1.—He investigated the invisible luminescence produced in metals by the impact of Röntgen rays; he calls it crypto luminescence.

RADIATION PHENOMENA IN THE MAGNETIC FIELD. Preston. "Phil. Mag.," April.—Descriptions of some experiments, the object of which was to triple the lines of the spectrum and of making a general survey of the spectra of various substances.

TRANSPARENCY OF BISMUTH IN A MAGNETIC FIELD. Buisson. Lond. "Elec., April 1.—A brief abstract of a French Academy paper describing experiments to see whether the transparency is increased in a magnetic field like the electric resistance. He found that the transparency was the same whether in or out of the field, but that the resistance increased at least 60 per cent. Others have shown that the resistance is different for continuous and for oscillatory currents, and that each resistance varies differently in a magnetic field; the change also depends on the frequency; in the case of the luminous phenomena it is independent of the field, and the frequency attains that of light.

ROTATING FIELD. Braun. "Elek. Zeit.," Mar. 31.—An illustrated article on rotating fields produced by Foucault currents, leading to a method of examining rotating fields. If the core of an alternating current magnet be continued beyond the coil in the form of a semicircle, a rotating field will be produced in the concave area; this may be shown by placing a cathode ray tube in this space and noticing the alteration in the shape of the fluorescent spot at the end of the tube; several forms of these spots are shown, as also the effect of the shape of the polar extension on the shape of the spot. Some motors constructed on this principle are shown, and an examination into the phenomenon is made. It is assumed that the magnetic polarization or propagation of magnetism takes place instantly, that is, without retardation, but that the Foucault currents produced act to produce a resultant rotating field. In applying it he obtains a sort of combination synchronous and non-synchronous motor. The principle may be applied to examining a rotating field; if, for instance, the armature of a rotating field motor is removed and a cathode ray tube is placed axially in different parts of the field, the field may be examined, as the luminescent spot will be formed as ellipses whose axes in the same field are nearly parallel but whose eccentricities are different; the direction of the principal flux is that of the shorter axes, while the longer one measures the density of the lines of force; on the outside of the motor the axes of the ellipses were not parallel. A flat coil may be used instead and placed in different parts of the field, with its terminals connected to the cathode ray tube through an induction coil; by placing the spool in different positions various measurements of the field can be made. One advantage is that the density of the lines of force is measured directly.

WHAT IS ELECTRICITY? "Amer. Elec., April.—Comments by Steinmetz, Trowbridge, Webster, Macfarlane, Kennelly, Swinton, Reed, Wolcott and Elihu Thomson on the article noticed in the Digest" March 26, the conclusions of which are favorably criticised. Macfarlane states that those who, in attempting to understand electricity seek for an agent or a force, do not understand the modern doctrine of energy. Kennelly believes it quite possible that an electrical charge is an entity in addition to and apart from the electrical energy which accompanies it; a charged insulated metallic sphere may, perhaps, not only be the focus of electrical energy in the surrounding ether, but may be, possibly, the seat of an entity even if this entity be not a substance; if it could be shown that electrostatic flux consisted of a particular kind of stress or displacement in the ether, then the charged sphere would be surrounded by a distribution of this displacement, which might be called electricity, the energy contained in the displacement being electrical energy. Swinton does not despair of the possibility, not only of light without heat, and of the electrical transmission of power on a large scale without wires, but also even of the obtaining of energy by other means than oxidation of carbon; as, for example, directly from the radiations that come to us from the sun or from other sources internal or external to the earth. E. Thomson thinks that if the truth were well known to us, we should find that electrical actions are far more simple than what we regard as purely mechanical ones; he is led, as a matter of philosophy and speculation, to think that if we could see far enough we should find that gravitation, cohesion inertia and other mechanical forces and properties, as well as chemical attraction, are in some way dependent upon the electromagnetic properties of ether, and if we really understood the meaning, or could form in our minds an image of electrical actions, we should have the key to nearly all others.

CONDENSERS IN ALTERNATING CURRENT WORKING.—"Amer. Elec.," April.—The practical uses of condensers are described in decreasing the idle current, for obtaining voltages higher than that of the circuit, and for application in connection with regulating apparatus. It is shown that by means of an inductance a voltage smaller than that of a given circuit may be obtained; and that by use of an inductance in series with a condenser, voltages higher than that of the circuit may be obtained, up to a voltage corresponding to the limit of insulation of the condenser. In connection with regulating apparatus, a condenser in series with an inductance will multiply the circuit drop, the amount of this multiplication being only dependent upon the size of the inductance and the amount of strain the condenser will withstand.

APPARENT INCREASE OF RESISTANCE OF ELECTRICAL CONDUCTORS.—"Amer. Elec.," April.—This phenomenon is explained on the assumption that a conductor may be considered to be composed of an infinite number of filamentary conductors; when a current flows, those filamentary conductors which lie nearest to the axis of the conductor will be subject to greater inductive action than those lying on the circumference; the consequence is that as the counter E. M. F. set up by this inductive action between the filamentary conductors will be strongest at the axis and weakest at the periphery; there will be greater opposition to the flow of current along the axis, and therefore the flow will be least there, increasing toward the circumference. At commercial frequencies this phenomenon need not be considered, except in the case of very large conductors. Where a solid conductor would be very large in diameter, such as on the switchboard of a large generating plant, a tubular conductor should be used instead, as when the cross section is annular the effect is much lessened, for the reason that the filamentary currents are at a greater mean distance from each other.

ALTITUDE OF THE AURORA. Abbe. "Terrestrial Mag.," March.—The beginning of an article in which he collects some of the numerous observations, calculations and opinions bearing on the nature and altitude of the aurora light.

NATURE OF ROENTGEN RAYS.—"Am. Jour. of Sc.," April.—A brief abstract of an article by Stokes from the "Manchester Memoirs," 41, Part 4.—He believes that these rays are transverse vibrations of the ether, and that the cathode rays are streams of rapidly moving particles; the apparent transparency of aluminum plates to cathode rays is thought to be the result of a process similar to that which happens to a copper plate immersed in a copper solution which is undergoing electrolysis, and is being dissolved on one side, having copper deposited on it on the other. The deflection of cathode rays by magnetic and electrostatic forces he regards as a great objection to considering them as light rays. He believes Röntgen rays are impulses and not vibrations. This is followed by a brief abstract of a paper by J. J. Thomson in the "Phil. Mag." for February., which has already been noticed, and in which he elaborates the impulse theory from the view of the electromagnetic theory of light, concluding that in the X-ray phenomena there are two waves from the electric impulses, one of which is a spherical wave and the other a plain one, the dimensions of the latter being extremely small; X-ray effects are therefore produced at the surface where the electrified moving particles are stopped.

TEMPERATURE COEFFICIENTS OF STEEL MAGNETS. Durward. "Am. Jour. of Sc.," April.—He carried out a series of measurements for the temperature coefficients of a large number of glass hard magnets described last year in that journal by Peirce, the magnets being made of different kinds of steel and carefully sea-

soned; he endeavored to find some relation connecting their temperature coefficients with their dimensions, but the results differ so widely that they were not capable of any very definite determinations. The method is described and the results are given in tables and curves; some of these show how the temperature coefficient and magnetic moment vary with their lengths between room temperatures and 100° C.; the temperature coefficients are functions of both diameters and the ratios of their lengths to their diameters; very long slender magnets have in general relatively small coefficients.

TERRESTRIAL MAGNETISM.—"Terrestrial Mag.," March.—A number of articles, including a very long one by Schuster on the investigation of hidden periodicities, with application to a supposed twenty-six-day period of meteorological phenomena. An extract on the relation of terrestrial magnetism to geology by Ruecker from "Nature," Dec. 23. A note in regard to magnetic disturbances on St. George Island, Bering Sea, by Putnam. A letter in German from von Bemmelen on new contributions to the collection of early researches in variations. A note on the international conference in terrestrial magnetism and atmospheric electricity.

Electro-Chemistry and Batteries.

ELECTRODEPOSITION OF METALS. Graham. Lond. "Elec. Rev.," April 1.—The conclusion of his paper (see "Digest," April 9). Inclining the small jets gave worse results; he then tried shielding by interference, using a sheet of vulcanite with holes through which the jets passed and obtained a very fine deposit with 3000 amperes per sq. m., the cathode being moved slowly to and fro in front of the jets. A very rapid circulation of the electrolyte appears to be the principal condition of success; two forms of apparatus which were devised, are illustrated, one for covering a wire and the other for a flat plate. The results of some observations are given for determining the voltage between the anode and the cathode at various current densities. In his experiments the anode, as well as the cathode, is very energetically washed, which has little effect on a lead anode, but with one of copper the effect was most striking. He tried a mixed solution of iron and copper sulphates, using a current density of 550 amperes per square meter, the electrolyte being rapidly circulated, but not a trace of iron was discovered in the deposit, even if there was only a small amount of copper in the solution; nor did it seem to make any difference whether soda, potash, zinc or aluminum were present in large quantities; this therefore affords a ready means for depositing copper in an almost pure state from the very pure solutions obtained by lixiviating certain ores. Solutions were obtained from a Spanish mine, where large quantities are produced, containing about 1 per cent. of copper, and from this the copper was extracted without any difficulty, with 550 amperes per sq. m., and the deposit could be drawn into wire. The metals were in solution in the form of sulphates, but the results were not satisfactory with the chlorides, and it is therefore necessary in such an application to convert the chlorides into sulphates.

TREATMENT OF BATTERY SLIME.—Lond. "Elec. Rev.," April 1.—A brief note from a recent paper by Williams, stating that an electrolytic process is now being used in South Africa for removing the gold from slimes which were formerly not used; the process is working very successfully; the results of two months' working are given; 60.48 per cent. was extracted with a profit of $15,000.

DISTURBANCES IN ELECTROLYTES. Volterra. "Nuovo Cimento," Jan.; abstracted briefly in the Lond. "Elec.," April 1.—The action of ultra violet light on the spark gap is modified when the gap reaches a length called the critical distance; he tried to trace a similar discerning action in the effect of local disturbances on the discharge through electrolytes.

THERMAL PHENOMENA IN ELECTROLYTES. Cardani. "Nuovo Cimento," Jan.; noticed briefly, with an illustration, in the Lond. "Elec.," April 1.—He applied his petroleum thermometer to the study of thermal phenomena in electrolytes.

MUTUAL DIFFUSION OF ELECTROLYTES. Behn. "Annal. Phys. Chem.," 61, p. 54; noticed briefly in "Science Abstracts," Jan.—He describes experiments made to determine the number of ions passing over a surface of contact between two homogeneous solutions of binary electrolytes. Distinct evidence was obtained of diffusion against the concentration gradient.

ELECTROLYSIS OF AQUEOUS SOLUTIONS. Glaser. "Zeit. f. Elektrochemie," March 20.—The conclusion of his long article (see "Digest," April 2). The chief conclusion from the last part is that the decomposition of water is in certain cases chiefly a secondary reaction. These researches were made at the suggestion of Nernst.

REDUCTION OF NITRO-BENZOL AND NITRO-TOLUOL. Loeb. "Zeit. f. Elektrochemie," March 20.—A short article on theoretical and experimental researches.

THEORY OF REVERSIBLE CELLS. Darrieus. "L'Eclairage Elec.," March 19.—A continuation of his long serial; he discusses the electrolytic action of the acid.

PULVIS ACCUMULATOR. Miron. "L'Ind. Elec.," March 25.—A description of this French accumulator; the active material is made of finely pulverized lead without any oxide, and secured in a grooved lead plate; there is mixed with the lead powdered pumice stone, which is said to make it extremely porous. The pulverized lead is produced by blowing a stream of air through a fine jet of molten lead. The capacities for various rates are given and for a ten-hour discharge it is about nine ampere hours per kg of electrodes.

DRY CELLS. Wynne. "Amer. Elec.," April.—The internal resistance of dry cells is considered so far as it affects the working voltage; a method is given for the testing of dry cells, and the determination of their internal resistance.

ANALYSIS. Ulke. "Eng. and Min. Jour.," April 9.—Descriptions of improved methods of analysis of ores, slimes and deposits in the electrolytic purification of copper, nickel, etc.

Units, Measurements and Instruments.

LEGALIZING ELECTRICAL UNITS IN GERMANY.—"Elek. Zeit.," March 31.—A reprint of a long official document, accompanying the proposed bill noticed in the "Digest" last week, giving reasons, explanations, etc. An editorial in the same issue contains criticisms by the Union of the German Electrical Engineers of the original propositions. Among other things the word "amper" is objected to; as energy is sold in watt hours that term ought to be defined legally; it proposes to define the watt for alternating currents as the amount of energy, which would produce in the same conductor and in the same time as much heat as a continuous current devoloping 1 watt. Not only the E. M. F. and the current of an alternating current should be defined, but also the energy or power, including also the conditions under which they should be calculated. It appears that not all of these suggestions were adopted in drafting the proposed law.

PERMANENCY OF THE CLARK CELL. Cooper. Lond. "Elec.," April 1.—A short article on the Board of Trade standard form. He believes it will be generally conceded that the accuracy claimed, namely, 1 part in 1000, can be obtained by carefully following the directions, but as regards secular change, the specification is not so satisfactory; there is a marked tendency of the E. M. F. to fall, until finally the cells are no longer accurate. He gives a table of results illustrating this; it contains the errors observed in a number of cells covering periods of a number of years; these show that the cells generally start low, but assume their normal value in about a week or ten days, the mean error then amounting to 1 in 7000; the E. M. F. then steadily falls, until at the end of nearly 3.5 years two cells had an error of about 1 in 700, and three others in less than three years an error of 1 in 500.

VARIATIONS IN THE E. M. F. OF CLARK CELLS. Spiers. Twyman and Waters. "Phil. Mag.," April.—A publication in full, with the illustrations, of the Physical Society paper noticed in the "Digest," Dec. 11.

MERCURY INTERRUPTER. Roiti. "Elettricista," Nov.; abstracted briefly in the Lond. "Elec.," April 1.—He describes a mercury spring interrupter which allows for a great range of frequencies. The point of a spiral spring dips into mercury, and when the circuit is established an iron core inside of the spring becomes magnetized, attracting the spring and breaking the current; "the stem carrying the core carries also a kind of toothed wheel, which gears into the spiral from the inside. By turning the stem round, and raising or lowering it, the number of turns which are free to vibrate may be altered, and the frequency thereby modified. The mercury and spring are contained in a tube, and the former is surmounted by petroleum, which prevents ozidation and damps the motion of the spring.

DETERMINING THE FREQUENCY OF ALTERNATING CURRENTS. Kinsley. "Phil. Mag.," April.—A description of a simple apparatus with which he claims to have obtained great accuracy. It is based on the vibration of an air column. A telephone is placed in front of a tube which, if the right length, will reinforce the note produced by the alternating current in a telephone; he then shows that by merely determining the length of the tube for the condition of maximum resonance, the frequency may be calculated from it; a brass tube with a movable piston is used. It appears also that the various harmonics can be detected. Some tables for corrections are given and the formulas are deduced.

THERMO-ELECTRIC PYROMETERS. Stansfield. Lond. "Elec.," "Elec. Rev." and "Elec. Eng.," April 1.—An abstract of a Physical Society paper, with the brief discussion. He describes a device for giving a more open scale for short temperature ranges, which include particular points, such as melting or freezing points. Two galvanometers were arranged in parallel, their deflections being recorded on the same photographic plate, the less sensitive galvanometer covers the entire range of temperature, and the other magnifies the special portion of the range; in the latter the E. M. F. is partly compensated by an opposing one from a Clark cell.

RESISTANCE AND TEMPERATURE.—Lond. "Elec. Eng.," March 25.—A brief description of Callendar's electric method of measuring the temperature of a metal surface on which steam is condensed.

THE BOLOMETER. Langley. "Am. Jour. of Sc.," April.—A short article in which he describes the present condition and form of the instrument, considering it under the head of precision, accuracy and sensitiveness. At present the apparatus under consideration will indicate a change of temperature much less than one ten-millionth of one degree Centigrade. (The bolometer was first described by that writer under the name of an actinic balance in that journal for March, 1881).

NEW FORM OF MAKE AND BREAK. Knipp. "Am. Jour. of Sc.," April.—A brief illustrated description of a contact device

attached to a pendulum for operating a seconds sounder; it is easily constructed and readily attached, and has given satisfaction; the circuit is closed only when the pendulum passes through its lowest point, although there are two contacts, one on each side of the pendulum.

MAGNETIC OBSERVATORY AT PARC ST. MAUR. Moureaux. "Terrestrial Mag.," March.—A short descriptive article in French, with an illustration and plan of this observatory near Paris.

A LECTURE ROOM GALVANOMETER. Quick. "Amer. Elec., April.—A description, with dimensioned illustrations, of a cheaply constructed galvanometer for use during lectures in connection with a stereopticon.

Telegraphy, Telephony and Signals.

SPACE TELEGRAPHY. Lond. "Elec. Eng.," March 25.—A brief notice of a recent lecture by Lodge, in which he questioned the value of the present systems of wireless telegraphy, but stated that he had an entirely new system for which he had hopes and which would send messages to great distances; it is based on magnetism, and is therefore independent of obstacles. No further description is given, but it appears to be promised in a subsequent paper.

TELEGRAPHY WITHOUT CONNECTING WIRES. Lond. "Elec. Rev.," April 1.—A note stating that a system is being applied to permanently establish communication with the Flat Holm Island, in the British Channel, and the shore, a distance of 3.75 miles. A line of wire three-fourths of a mile long is erected along the shore, the ends terminating in the sea; there is a similar line on the island half a mile long; the transmitting apparatus is a circuit-breaker making 250 makes and breaks per second, and in this circuit there is a Morse key, while on the receiving apparatus there is an ordinary telephone receiver.

DUODECAPLEX TRANSMISSION. "L'Ind. Elec.," March 25.—A note on the Mercadier system, which is at present being tried on the Paris-Bordeaux line for sending twelve messages simultaneously over the same wire. Alternating currents are used; the system resembles the old harmonic system in principle, there being vibrating reeds at the transmitting end, while the receivers are telephones, each of which responds to only one set of vibrations.

HUGHES DUPLEX ON THE BERLIN-LONDON LINE.—"Elek. Zeit.," March 31.—For some time experiments have been made to use the Hughes apparatus as a duplex on this line, and the results have been so satisfactory that the method is now used. The present article is an illustrated description taken from a German journal.

TELECTROSCOPE.—"Elek. Anz.," March 31.—In a short note on this apparatus for transmitting pictures (see Digest," April 9) a different description is given of the receiver than was given in the first abstract. The receiver is said to be precisely like the transmitter, the general principle being that if the two sets of mirrors move precisely alike the image will be reproduced. The oscillations of the mirrors are so rapid that the whole picture is given in a tenth of a second, and being repeated, the eye sees it as a permanent image. As the first exhibition is to be in 1900 it is thought that all the difficulties have not yet been overcome.

CABLE TO ICELAND.—"Elek. Zeit.," March 31.—A note stating that arrangements have now been concluded, and that this cable will be laid during the present summer; it extends over the Faroe Islands.

A FACTORY TELEPHONE SYSTEM. Fitch. "Amer. Elec.," April.—An inexpensive interior telephone system is described and illustrated. Three wires are employed; the call bells are in series on one wire, the speaking apparatus on another, the third wire being a common return. The call boxes are plain magnetic bells without switches; a simple form of telephone switches is used.

WIRELESS TELEGRAPHY. "Elec. Eng.," April 14.—An illustrated description of the perfected Clarke apparatus.

LACROSSE, WIS. Cravath. "Elec. Eng.," April 14.—A brief illustrated description of the independent telephone exchange, which now has nearly 700 subscribers.

SELECTING A TELEPHONE. Clausen. "West. Elec.," April 9.—A short article giving general hints showing how to select a telephone.

Miscellaneous.

EXPLOSION OF FIRE DAMP. Conriot and Meunier. "L'Elec.," April 2.—A reprint of an Academy paper, giving the results of two years' researches with the explosion of this gas by electric currents. When the gas was in movement it was found impossible to ignite a mixture containing 80 per cent. of methane, by an incandescent wire, but illuminating gas was instantly ignited, showing an essential difference; a flame seems to be necessary to produce ignition. They come to the following conclusions: That incandescent metallic wires cannot produce an explosion of even the most explosive mixture; the explosion when it takes place is due to the arc or spark formed when the conductor is ruptured while the current passes. (These conclusions do not seem to agree with those from the elaborate series of tests noticed in the "Digest," Jan. 29, Feb. 5 and 12.)

RIVETING BY ELECTRICITY. Kodolitsch. Lond. "Elec. Rev., April 1.—A brief abstract from a recent paper. After two years of experimenting he succeeded in constructing a machine which supersedes those worked dydraulically or pneumatically; the machine closed 1200 rivets per day of ten hours, when operated by three men and a boy.

DIRECT TRANSFORMATION OF HEAT INTO WORK. Lond. "Elec. Rev.," April 1.—A translation of the article noticed in the "Digest," March 26.

PECULIAR ACCIDENT.—"L'Elec.," March 26.—A description of an accident which occurred in Bale, Switzerland. A telephone wire broke and crossed a trolley wire, grounding it, and thereby causing the wire to become red hot; a young man came in contact with it, was thrown to the earth and the wire cut his neck through to the backbone. An interesting legal question arose as to where the blame should be placed.

CURATIVE ACTION OF OXYGEN AND OZONE. Andreoli. "L'Elec.," March 26.—A short article describing the success which an English physician has had with oxygen as a cure for open wounds and ulcers, and stating that he is now experimenting with ozone, the action of which is supposed to be even better.

BIOGRAPHICAL. "L'Energie Elec.," March 16.—A long article on the work of Zenobe Gramme and of the present French company by that name. A full page portrait is given as a supplement.

LOCATING SUBMARINE MINES. "El'ty." April 13.—A description from the Chicago "Times-Herald" by Gray of his proposition to use the same principle as that in his telautograph, in order to show the location on a map, of submerged mines. Two points of observations are established on the shore, and the object, say a vessel, is sighted from both; on a carefully prepared map two pointers will follow the directions of the two instruments and their intersection will show the location of the ship on the map; the location of the mines being also indicated, it will at once be seen over which of the mines the vessel was passing. Another method of firing a mine is suggested, and consists in the use of a camera obscura, the table of which contains a map showing the location of the mines; the position of a moving vessel over these mines is then easily followed.

DEATH BY ELECTRICITY. Bleyer. "Elec. Rev.," April 13.—A short reply to the recent article by Hedley, which he claims contains nothing original. The present writer, who has experimented largely in this field, concludes that death is due to various conditions, and therefore each case must take these into consideration; not in any two cases perhaps do criminals die from the same electrophysiological result. One of the chief causes he found was due to dynamic apoplexy, but all electrocuted criminals do not die from this cause.

ELECTRIC APPLIANCES IN COAL MINES. "Eng. and Min. Jour., April 9.—An abstract of the recent report by Heise and Thiem, which was abstracted in the "Digest," Jan. 29, Feb. 5 and 12; see also last week.

ELECTRICAL CATECHISM. "Amer. Elec.," April.—The current installment of this series is on the magnetic field.

WAR NEWS. "West. Elec.," April 9.—A few notes on electrical preparations and proposals in connection with the possible war.

ELECTRICAL APPARATUS FOR AMUSEMENT. Hopkins. "Amer. Elec.," April.—A description with working drawings is given of a padlock containing a small magnet, which can be unlocked only by bridging over a gap in a concealed conducting circuit on the padlock.

Arc Lamps for Textile Goods Factories.

Textile manufacturers throughout the country for many years have been carrying on experiments in their endeavor to secure an artificial light which would enable their operatives to work with the same facility as in actual daylight, and to produce material in the dark winter days not less perfect than that made in the full light of summer.

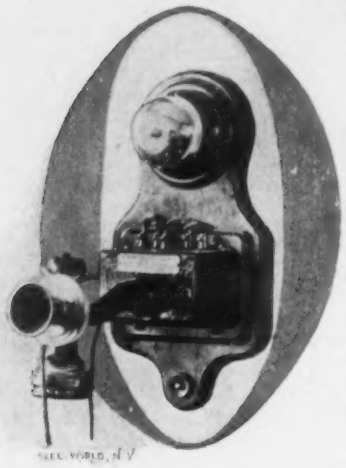
The series arc lamp of the type commonly used to illuminate the city streets has been, and even is now, in use in many mills. This lamp, with a clear globe, as generally used, has been found too glaring and penetrating, and while giving a large quantity of light has proved inconvenient and unsuitable on account of the uneven diffusion of the light, the creation of heavy shadows and the necessity of changing the carbons daily. The inverted arc lamp, with the inverted umbrella-shaped reflector, has also been tried, and, while the results have been fair, the combination of the large reflector and the lamp is cumbersome and objectionable in appearance, while the necessity of keeping walls and ceilings constantly white is expensive.

The advent of the enclosed arc lamp has, for the first time, given the textile manufacturer a means of illumination which overcomes almost all the different objections, and is peculiarly adapted for all classes of mill work.

Arc lamps of this type, known as enclosed arc lamps, were first developed for direct current, and have come largely into use. They have recently been perfected by the General Electric Company for use on alternating current circuits also; and may, therefore, be used either in mills already furnished with their own direct current or alternating current dynamos, or taking electricity from systems used to light the city streets.

The direct current enclosed arc lamp burns for about 150 hours with one trimming, that for alternating current about 100 hours. In certain mills where these lamps have been installed the light is seldom used in summer, and in winter only a few hours daily. Under these conditions recarboning is necessary only about twice a year, while the cost of carbons is about 5 cents. Of course, in other mills where artificial light is necessary for longer periods during dark days or into the night recarboning is necessarily more frequent, but compared with open arc lamps the cost of attendance is very small, while that for carbons shows a marked economy. With open arc lamps a large amount of carbon dust collects in the globe; thus, when the globe is cleaned or dusted out by the trimmer the dust usually settles over everything that may be in the vicinity.

New Developments in Independent Telephony.



NE of the most unique and complete telephone systems, having many features entirely new in independent telephony, will, for the first time, be put to public exchange use by the Stromberg-Carlson Telephone Manufacturing Company, at Lockport, Ill. The system will have no batteries or generators at the subscribers' instruments, the talking battery and the calling energy being all placed at the central office.

Fig. 1 represents a subscriber's wall instrument. It is equipped with the company's long-distance transmitter, compound receiver, in connection with the induction coil, switch, etc., mounted as on the regular telephone, and has the ringer and gongs placed underneath a neatly designed shelf where the battery box is usually placed. Between the shelf and the transmitter box is a small push button, used for calling the central office. Just above the transmitter box, at the top of the backboard, is a circular card of directions. At the top are the connecting posts and a bar lightning arrester.

Fig. 2 shows the company's latest metallic switchboard, which is used in this system. The board is equipped with the company's regular double-coil drop and improved rapid connecting system. No separate ringing and listening keys are used. The entire operation is performed with the plugs. The jacks are so constructed that when the listening plug of a pair of connecting plugs is inserted and lightly pressed in, it throws in the operator's instrument; when released

Fig. 1.—Central Battery Telephone.

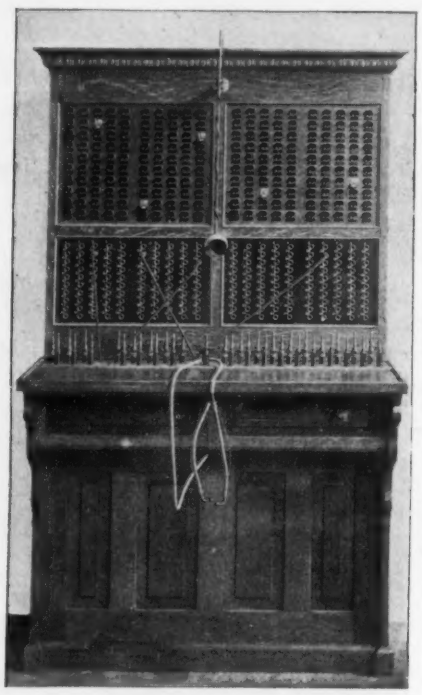


Fig. 2.—200 Metallic Line Board.

it automatically cuts out the operator's set and connects the subscriber with the cord. For calling, the other one of the pair (a ringing plug) is inserted and slightly pressed in while throwing in the generator circuit. Upon releasing the ringing plug the connection is completed. The operator's instrument and generator are connected with the subscriber direct through the jack and not through the cord. It is probably one of the most convenient and simple boards on the market, and is claimed to be entirely free from patent claims of others.

The initial illustration shows the wall instrument used with this system in interior exchanges.

Armature Construction.

In the construction of the armatures of all direct current generators and motors built by the General Electric Company, especial care is had to the production of as perfect and durable a part as possible, without sacrificing any detail essential to efficiency and perfect operation.

In the armatures of the new type of slow and moderate speed direct current generators and motors these characteristic features are strikingly apparent. The completed armature is a slotted body of barrel shape, so built that no part is susceptible to movement or vibration. There are no sharp bends to the wire over sharp metallic edges, and each coil is so laid on the core that the outer periphery of the core itself affords it complete protection from mechanical injury.

The spider castings holding the slotted sheet iron laminations are extended into cylindrical flanges at both ends. The coils, previously shaped on a form, are laid in the slots, and the ends lie along those flanges at each end of the spider instead of being bent down sharply toward the shaft. The coils are formed and

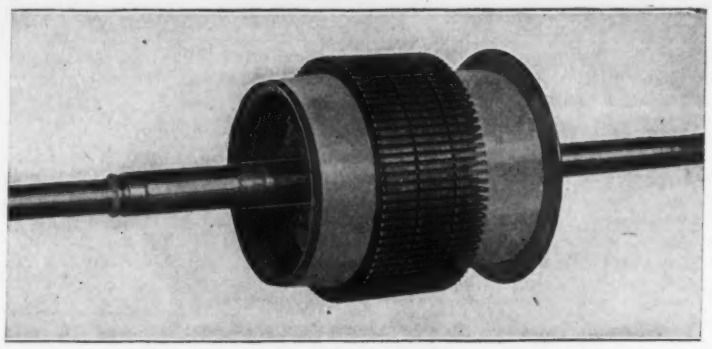


Fig. 1.—Slotted Barrel-Shape Armature.

insulated before assembling on the core, in order that before application in their final position they may undergo a careful test, and no coil is used that does not emerge from this with insulation intact. The insulation used is similar to that employed in the G. E. railway motors, and in the operation of these has given ample proof of its excellent qualities. It is tough, impervious to moisture and practically indestructible except under abnormal overload, while it affords high resistance to puncture, rendering injury from lightning extremely improbable. The insulated coils are laid in place in insulated slots in the core, and are simply pressed home. The advantage of this method compared with

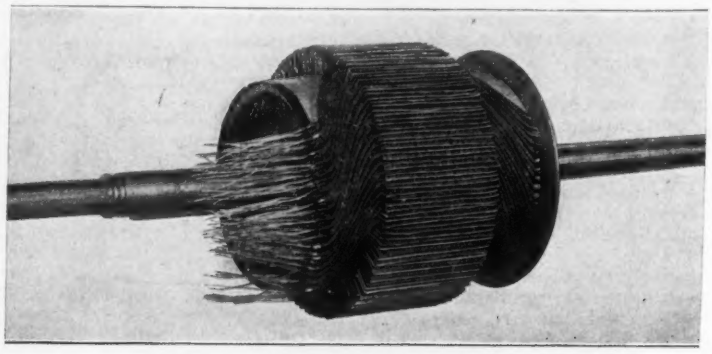


Fig. 2.—Method of Applying the Coils to the Core.

that employed on an armature with the wire wound directly upon it is obvious.

The cylindrical winding has many positive advantages. A very large radiating surface is provided for the conductors, and this, combined with special air ducts for the passage of currents of air through the core from the interior outward, tends to keep the armature cool; the length of wire is reduced to a minimum and consequently the losses due to armature resistance are also reduced, while the efficiency of the machine is greatly increased. The complete coil being formed separately and then applied any one or more coils may readily be removed and placed.

The coils are firmly secured in the slots on the cylindrical extensions so that

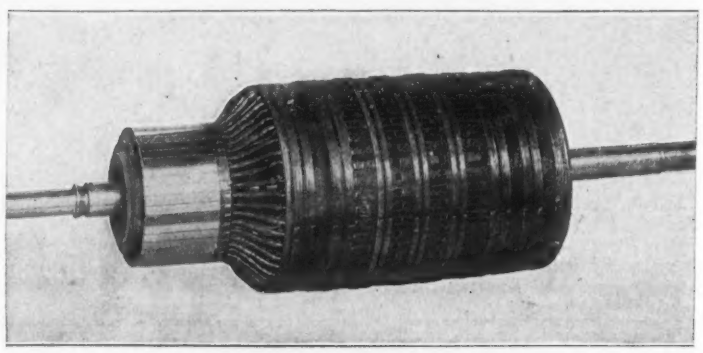


Fig. 3.—Cylindrical Winding.

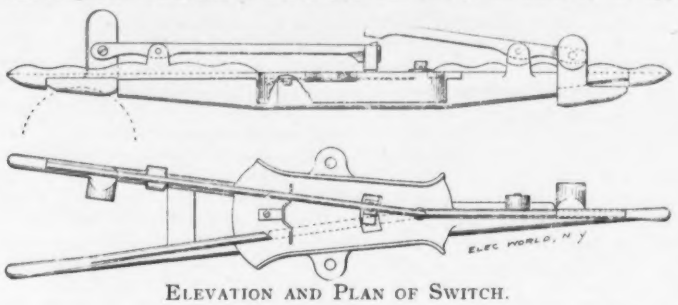
no part can move or vibrate. Indeed, rigidity is one of the most important advantages of the cylindrical winding, since without motion of the parts neither injury nor deterioration of the insulation is likely to occur. The ends of the coils are curved down to the commutator, and the connections are so arranged that open circuiting is impossible. The illustrations show the three different steps in the construction of a General Electric slow and moderate speed generator armature from the completed core to the completed armature. Fig. 2 shows the method of applying the coil to the core.

Automatic Overhead Trolley Switches.

A reliable and simple switch for overhead trolley construction has long been a necessity, and while many of the devices of this character already introduced perform their functions in a more or less satisfactory manner, a demand for something better has long existed.

The Acme Electric Specialty Company, 1302 Chamber of Commerce Building, Chicago, Ill., is manufacturing an automatic switch for single track turnouts that is commended to electric railway managers as a reliable device and extremely simple in construction. The principle of the switch will be quite readily discerned by reference to the accompanying illustration.

The tongue of the switch is moved from one wire to the other by the upper



ELEVATION AND PLAN OF SWITCH.

pressure of the trolley wheel against a lever. At each end of the switch is a hammer-head shaped device fixed to the end of a lever running parallel to the switch body. The fulcrum of the lever is near the hammer head, this arm of the lever being much shorter than the one opposite. The hammer head rests normally in a position slightly below the level of the trolley wire, so that when the advancing trolley wheel comes in contact with it the hammer head is forced up and the opposite arm of the lever down. At the end of the longer arm is a spur, which, when suddenly depressed by the impact of the trolley wheel, engages one side of a wedge-shaped pin permanently fixed to the switch tongue and passing through the top of the switch plate. This sudden blow on the wedge-shaped pin throws the tongue, and the car is enabled to pass onto or off the siding without danger of jumping the trolley. A similar mechanism is provided at the opposite end of the switch, thus rendering the operation reversible, according to the direction of motion of the car.

Several advantages are claimed for this switch. It is not necessary to slow up at turnouts, and the conductor need not neglect his other duties to hold the trolley rope to prevent the trolley from jumping at such times. The tongue of the switch is securely locked when shifted, and cannot be displaced by the vibration of the trolley wire or any other way except in the manner above described. The device is entirely new. It, however, has been practically tested, and in one instance the manager of a road expressd his satisfaction with its operation by ordering a dozen more switches.

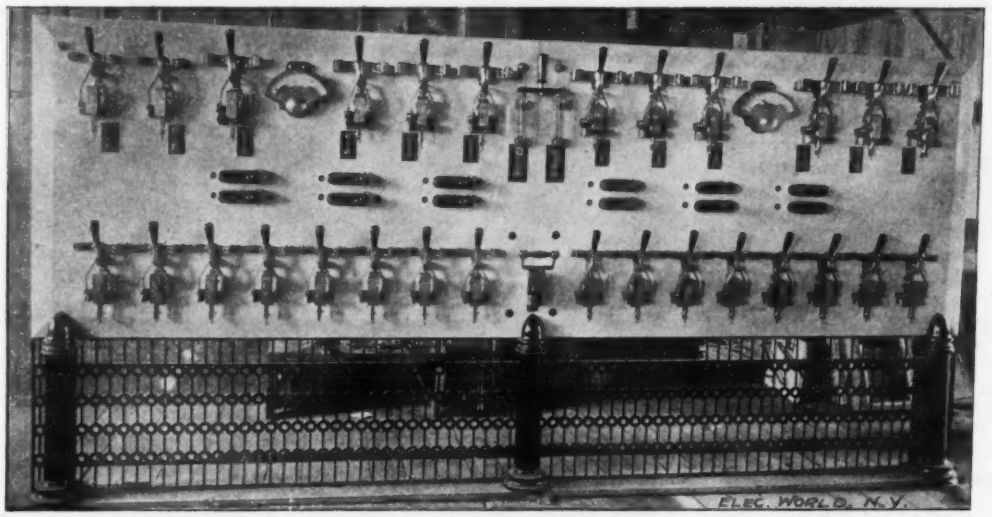
The illustrations show the plan and elevation of the switch.

Mooring Boats by Electromagnetic Power.

In THE ELECTRICAL WORLD of April 9 was published an illustrated article on the title subject, in which was mentioned, incidentally, the application of the principle to submarine torpedoes. Messrs. Johnson, Slack & Co., Easton, Pa., write that "the application referred to by Mr. Wellman (to torpedoes) was patented by us, grants being issued about fifteen months ago." They further state that "the electrical submarine torpedo" invented by themselves is now and has been in the hands of the Government.

A Modern Alternating Switchboard.

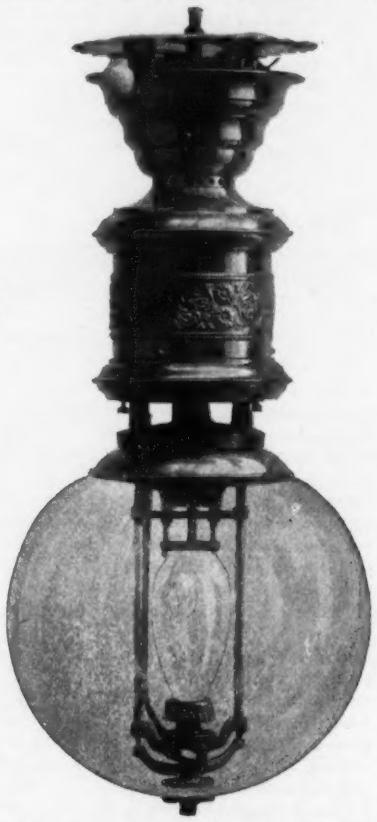
The W. S. Hill Electric Company, New Bedford, Mass., is just completing for delivery to prominent electrical plants some notable types of switchboards, one of which is illustrated above. This is a complete modern alternating switchboard. It is to be installed in the electric plant of the Long Island Hospital at King's Park, N. Y., and was built by the W. S. Hill Electric Company from plans furnished by Mr. F. L. Frost, electrical engineer for the State of New York. It is 12 feet long and 5 feet wide, a 3-inch bevel running entirely around it. Italian marble is used in its construction. The ornamental grill work is of the Hill Company's special design. The special feature of this board is that the secondary switches at the top, usually of a knife pattern, are of the automatic type, thus making it an ideal board of its class.



ALTERNATING SWITCHBOARD.

Enclosed Alternating Arc Lamp.

The non-focusing alternating arc lamp illustrated herewith is made by the Jandus Electric Company, Cleveland, Ohio. It is designed for circuits of from 7000 to 16,000 alternations per minute, and voltages from 100 to 120. It is 30 inches long and embodies in its construction the unique features of the Jandus products, the principal of which are the ring type of clutch and the carbon grip. In its general construction it is very substantial. The mechanism is so arranged that all joints and pivotal connections between moving parts are taut at all times, and for this reason it is said to be absolutely noiseless in operation. The solenoids are substantially wound and mounted on vibrating members from which they may be easily removed. A reflecting surface is provided and arranged as a part of the globe cap, which greatly increases the effective illumination and decreases the heat transmitted to the mechanism from the arc. A reactance or economy coil is placed in the canopy of the lamp, easy of access and conveniently adjusted for the voltage of the arc. As ordinarily adjusted the lamp shows a loss of but twenty watts on a six-ampere 100 to 110 volt line. The lamp ordinarily consumes from 400 to 450 watts across the terminals, thus showing an average efficiency of 95 per cent. Carbons 8 inches long, with one-eighth and one-sixteenth inch core, are furnished with the lamp. By using the stub of the upper carbon for a lower, in the succeeding run, but one fresh carbon per trim is necessary. The life of one pair of carbons is about eighty hours.

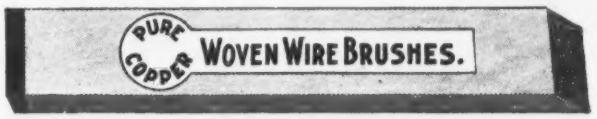


ENCLOSED ALTERNATING ARC LAMP.

The lamp illustrated is for inside service. That intended for outside use is similar in design, except that it is provided with a weatherproof top and the finish of the case is a dead black. The use of dense opal inner and clear outer globes is recommended for inside lamps, and both clear inner and clear outer globes for outside service lamps.

Woven Wire Brushes.

The Ohio Electric Specialty Manufacturing Company, Troy, Ohio, manufactures pure copper woven wire brushes of twenty-nine standard sizes, varying in dimensions from ⅜ inch wide x ⅛ thick x 6 long to 2 x ⅜ x 8 inches. These



WOVEN WIRE BRUSH.

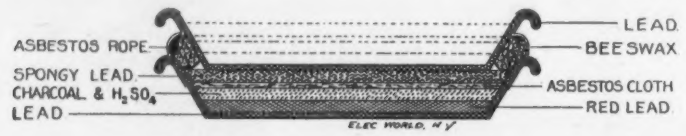
brushes are made from the finest quality of copper gauze, and are flexible in any direction, or stiff, if required. Being made of the purest copper means that they are of the highest conductivity, and consequently the heat losses are reduced to a minimum. This brush is said to be in every way a peer to the best brush in the market, and may be distinguished from all others by the trade mark, as shown in the accompanying illustration.

A High Tension Storage Battery.

THIS term, which tends somewhat to inspire incredulity, does not mean that the accumulator which it defines has a potential difference per cell greater than that of ordinary types, but that per plate the voltage is twice as great as in the ordinary construction. This result is attained by the use of one single plate for the positive of one element and the negative of the next. Although attempts have been made to do this from time to time heretofore, they have never been successful, commercially at least, owing to various troubles both chemical and mechanical, which seem to have been ably overcome in the arrangements devised and patented by Prof. N. H. Edgerton, president of the High Tension Electric Storage Company.

A storage battery of this type is very different in appearance from the ordinary accumulator, and consists of a pile of plates laid horizontally one on top of the other, with the active material applied as a paste between them. Perhaps the clearest idea of the construction can be given by a description of the various processes as they are carried out in the new works of the High Tension Electric Storage Company at Souderton, Pa., a view of which is given in the accompanying initial letter.

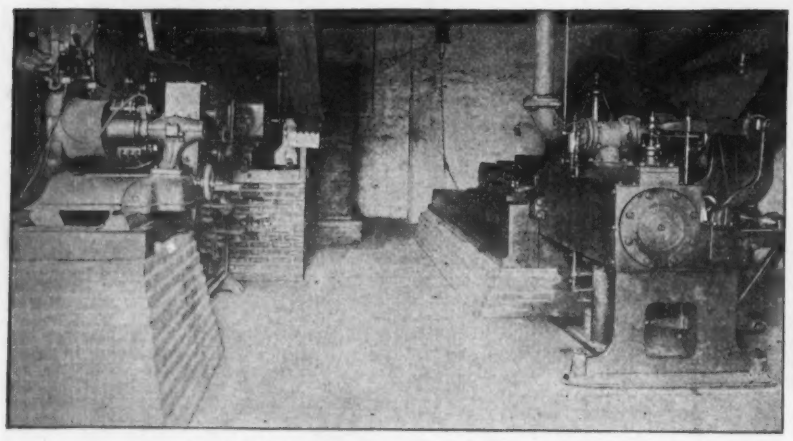
A plain rectangular sheet of lead about one-sixteenth of an inch in thickness and dependent in dimensions on the desired ampere hour capacity, is first stamped into a shallow pan or tray shape with outwardly flaring sides turning over to form a lip running at the top completely around the edge of the tray. In the bottom of this tray to a depth of one-eighth of an inch is placed a layer of paste of red lead saturated with sulphuric acid at a density of 30° Baume.



Cross-Section of Cell.

On top of this is placed another layer of about the same thickness of powdered charcoal, also saturated with sulphuric acid of the same density. Above this again is placed a sheet of asbestos cloth, on top of which is a layer about one-eighth of an inch of litharge, above which comes the next lead tray, the cyclic arrangement being repeated through the whole pile. When a pile of the desired number of plates is assembled, it is placed in a powerful clamping frame by which great pressure is applied, squeezing the various layers together. They are then taken to the sealing room, where the spaces between the outwardly projecting lips of the various plates or trays are calked with three-eighths inch asbestos rope dipped in melted beeswax. The latter material is also run over all parts of the plates projecting out beyond the calking ropes. The pile is then ready for forming, which is accomplished electrically by a slow charge lasting for about ten days and aggregating in ampere hours about three times the rated capacity of the battery. The internal resistance is at first, of course, very high, and the back E. M. F. low, but as the litharge changes to spongy lead and the acid soaks through the asbestos cloth, the battery assumes its proper characteristics, until at the end of this long charge it is ready for useful service, although not as yet perfectly formed, the behavior of the battery improving with continued use.

One of the peculiarities of this cell, indicating a chemical action different from that in the ordinary type, is the entire absence or fumes or odor. A simple test of this feature by a representative of The Electrical World at the works at Souderton, failed to disclose any odor from a large group of batteries being formed other than that of beeswax, this being the distinguishing odor in fact of the whole factory. This feature enables the batteries to be placed anywhere and everywhere without special ventilation or danger of corrosion. In the accompanying illustration there may be seen in the background of the engine room at the company's works the large battery described here the absence of any fumes allowing this arrangement without the slightest danger to any of the metal work of the electrical equipment. Even the terminal contacts of the main batteries do not require protection to prevent corrosion.



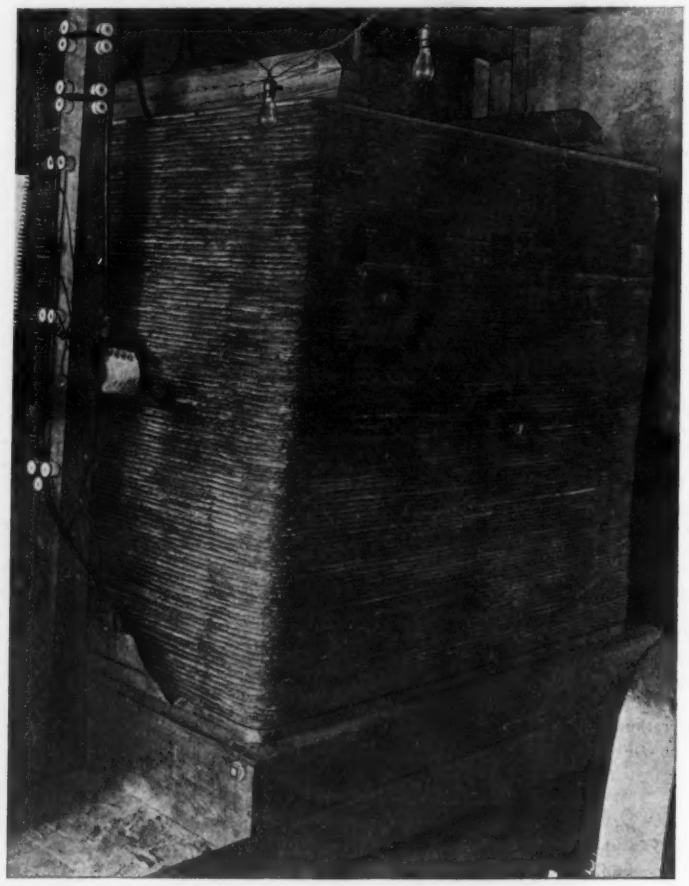
Storage Battery in Engine Room.

The largest battery yet made by the company is one of 460 kilowatts, having a capacity of 2000-ampere hours at 230 volts at a ten-hour discharge rate. This is the battery shown in the engine room, and is used by the company for charging and discharging the piles made for commercial use, electric power as a by-product being sold to the town for illumination purposes at night. Twenty-four enclosed arc lamps and several hundred incandescents are run every evening from this battery, the engine and dynamos being shut down at 6 o'clock and the battery left to do the rest. Voltage curves and curves of capacity at various discharge rates will be taken on this accumulator at some future time, but the development is so recent that careful records of this feature have not as yet been made.

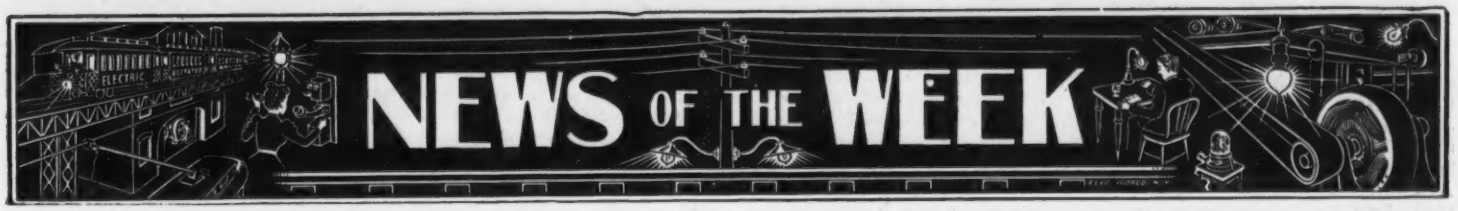
As might be expected the weight of such an accumulator per kw hour is considerably less than that of the conventional types, this ratio being about 75 pounds per kw hour, at a ten-hour discharge rate, at which all these batteries are rated. The capacity per square foot of plate area at this discharge is approximately sixty-ampere hours. The internal resistance of the battery appears to be very low as might naturally be expected, and the battery is consequently able to bear enormous overloads for a brief time at least. It is stated that a sixty-ampere hour pile, the normal discharge of which is six amperes, has given a current of 100 amperes for a brief time, with a drop of but 13 per cent. from the open circuit voltage. This indicates an internal resistance even less than the measured resistance found in the tests made for the Franklin Institute, in which a value of about .03 of an ohm per cell of 1 square foot area was found.

Another peculiarity of this cell is the seat of the E. M. F. It might be thought that this would be between the two layers of active material separated by the asbestos sheet, but the removal of one lead plate with the spongy lead on one side and red lead on the others shows with lead voltmeter terminals a difference of potential of about .8 of a volt between the surface of the spongy lead and the body of the lead plate, and about 1.4 volts between the surface of the red lead and the lead plate. The cells can be and have been run hermetically sealed, but to avoid the high resistance consequent on the partial drying of any one layer after repeated charges and discharges, a small opening is left at one side between the two ends of the asbestos rope, through which acid can be introduced.

With regard to the life and durability of the cell, it is claimed that some of the early experimental batteries, which have been in use for therapeutic purposes now for five years, show no distinct changes in their chemical or physical condition. The plates, when removed and scraped free from plastic material, are of the same thickness and solidity that they were in the first place. A large number of thirty-ampere hour eight-volt piles are now being made and sent out in neat oak boxes for carriage lighting purposes, as well as some large sixty-ampere hour thirty-volt sets similarly mounted for isolated plant work. Boxes of the latter, including fourteen plates, weigh 180 pounds each. The company is also equipping a 1000-volt sixty-ampere battery for supplying series arc light street circuits at the time of the peak of the load, the charging being done at other times from the arc machines.



460-kw Storage Battery.



Financial Intelligence.

SPRAGUE ELECTRIC COMPANY'S DIVIDEND.—The Board of Directors of the Sprague Electric Company, New York, has declared a dividend of 3 per cent. on the preferred stock, payable on May 2 to shareholders of record on April 18.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, April 18, 1898.

MR. SEARS B. CONDIT, manager of L. A. Chase & Co., Boston, was in New York during the past week. Mr. Condit states that business with his company is increasing notwithstanding the war scare.

THE ANNUAL MEETING of the stockholders of the Mexican Telephone Company will be held at the Astor House in this city on Wednesday, May 11 at 10:30 A. M, for the purpose of electing seven directors for the ensuing year, and transacting other business.

THE TELEPHONE RATE BILL.—The argument of Mr. U. N. Bethell, general manager of the New York Telephone Company, before the New York State Senate Finance Committee on the subject of the bill to regulate telephone charges in this State has been published in pamphlet form.

NEW ELECTROLYTIC EXTRACTION APPARATUS.—Mr. Thomas M. Chatard, at the meeting of the American Chemical Society, which was held at the College of the City of New York on the evening of April 15, described and exhibited the "Aurex sluice," a new apparatus and process for the electrolytic extraction of gold from ores.

THEFT OF COPPER WIRE.—On the night of April 10, 18,000 feet of new copper wire was stolen from the Flushing Electric Light Company, Flushing, Queens Borough, New York City. The wire had been strung on poles, but the lamps had not been placed. The thieves cut the wire close to each pole. About 800 pounds of the wire were stolen.

SCARCITY OF INSULATED WIRE.—It is stated that electrical contractors are greatly delayed in completing their contracts on new buildings in this city on account of the scarcity of insulated wire. This condition of things arises from the fact that the United States Government has bought up all the available wire in the market to meet the extraordinary requirements consequent upon the preparations for war.

THE FIFTH ANNUAL RECEPTION of the New York Academy of Sciences was held in the American Museum of Natural History on Wednesday and Thursday evenings of last week. Fifteen departments of science were represented, and interesting displays of apparatus, specimens, etc., were made. On Wednesday evening Mr. Charles E. Tripler lectured on liquid air, and performed some interesting demonstrations before a large audience. On Thursday evening Professor Hale lectured on the same subject.

THE NEW YORK TRADE SCHOOL held its seventeenth annual commencement exercises on Wednesday evening last, at the school, First Avenue, Sixty-seventh and Sixty-eighth Streets, this city. Mr. William E. Dodge delivered the commencement address. Certificates were presented to the members of the various classes, including the class in electrical work. The certificates in the electrical class were presented by Mr. J. J. Smith. An outline of the electrical work taught in this school was published in THE ELECTRICAL WORLD of November 6, 1897.

THE MAGNETIC CLUB celebrated its tenth anniversary with a dinner at the St. Denis Hotel on the evening of April 13. There were about 150 persons in attendance, and an extremely enjoyable time was had. A handsome souvenir menu card bore the portraits of every president of the club, arranged around a horseshoe magnet. The design was executed in colors, and was very attractive. The after-dinner exercises consisted of a well arranged programme of vocal and instrumental music, beside appropriate addresses. The festivities concluded with the singing of "Auld Lang Syne."

THE MACKAY MAUSOLEUM.—The magnificent tomb built in Greenwood Cemetery, Brooklyn, by Mr. J. W. Mackay is now lighted and heated by electricity, the electrical equipment having been installed by Messrs. Zimdars & Hunt, of this city. It is just finished, and is reported to be working very successfully. The interior is lighted by sixty incandescent lamps arranged around the base of the dome and hidden from view from below, shedding a soft, diffused light downward. The electric heater, which was especially made, is placed underneath the marble floor, under the apex of the dome. It is run in four sections, taking twenty, forty, sixty and eighty amperes of current. The supply of fresh air is conveyed from the outside to the heater through a duct, and after becoming heated rises into the room above. At the top of the dome ventilators are provided for the egress of the heated air. The building is wired on the three-wire system, the heating apparatus being connected with the two outside wires and operated at 220 volts, while the lighting is done at 110 volts. A very handsome panel board for the control of the circuits is let into the marble wall, and is protected by a heavy bronze frame door. The Edison street current is used in this unique installation.

MR. EDISON WILL JUDGE AND LOOK WISE.—Mr. Fred Catlin, manager of the fast sending telegraph tournament, which will be held in connection with the Electrical Exhibition at Madison Square Garden next month, is an old-time personal friend of Mr. Thomas A. Edison, the two being co-workers in the earlier days of the telegraph. Mr. Edison in later years, as everyone knows, has given his entire attention to other things, but has not wholly lost interest in matters pertaining to telegraphy; and when anything of special interest in the telegraphic field is brought forward he is always ready to extend encouragement and aid. Knowing the personal interest Mr. Edison takes in such affairs, Mr. Catlin invited him to act as one of the judges of the contest next May. A reproduction of Mr. Edison's reply is given above.

Orange, N.J. April 9/98

Friend Catlin.

Yours of March 30 Received.

I may come over and act as a judge of 50 word a minute Morse, but I am afraid I would not understand it. The Morse that I was brought up on was about as perfect as the record slip on a deep sea cable, But of such fossils as Bunnell, Brown Delaney and Martin are going to pretend to read copper plate Morse, then I may come over and look wise

Yours Edison

THE ELECTRICAL EXHIBITION.—The executive office of the Electrical Exhibition Company is now located at Madison Square Garden. Mr. Samuel Insull, president of the National Electric Light Association and of the Association of Edison Illuminating Companies, was in New York last week. He takes a lively interest in the progress of the exhibition, and has informed the managers that he will take the utmost pleasure in being present in behalf of the two bodies to participate in the opening exercises of the exhibition on May 2. These exercises as now arranged promise to be of unusual interest. A meeting of the judges of the telegraph contest, which is to take place during the exhibition, was held at the Astor House on the afternoon of April 13, An executive committee was appointed to take care of all matters embraced in the duties of the judges. Mr. T. J. Smith was appointed a committee to arrange for suitable phonographic records, and Mr. P. B. Delany to provide apparatus for other records not phonographic. The executive committee will hold another meeting on April 21. Friday evening, May 13, and Saturday afternoon and evening, May 14, are the dates set on which the tournament will take place. It is stated that about fifty associations of the National Association of Steam Engineers will hold meetings at Madison Square Garden during the month of May. They will be the guests of the Exhibition Company on their regular meeting nights.

BRIDGE COMMISSIONER SHEA says that the cable service on the bridge may be stopped altogether, and all the employees engaged in it discharged just as soon as the elevated railways begin running their trains across. This would effect a saving of $50,000 a month in the running expenses of the bridge. Such a plan, he said, is under consideration. Superintendent C. C. Martin is also of the opinion that the cable service will have to be abandoned when the elevated trains begin running. He believes, however, that the revenue derived from the railroad companies for their exclusive privileges will be ample to maintain the bridge, paying its ordinary running expenses. A conference between Bridge Commissioner Shea and the representatives of the Brooklyn trolley railroads concerning an increase of rates for the privilege of running cars across the bridge took place one day last week. The representatives of the trolleys argued against any increase. They said that for two years the revenue of the bridge had been less than its operating expenses, and that the city was a gainer under the new arrangement even if no tolls were charged for the trolley cars. They said 100,000 persons ride across the bridge every day on the trolley cars, and everyone of them saves the amount which it formerly cost him to ride on the regular bridge cars. They stated that the average cost of a round trip across the bridge for a trolley car was 29 cents, and they ought not to be asked to pay any more. Mr. Shea said in reply that the bridge receipts had fallen off to the extent of $700,000 a year. He asked the trolley representatives to submit a detailed statement of cost of operating, number of passengers carried, etc., and to have another conference in the near future, which was promised. The report that the cable railway service on the bridge may be discontinued when the elevated railways begin running their trains over to Manhattan has aroused a strong opposition in that section of Brooklyn in the neighborhood of the bridge terminal. Thousands of people living in that section, it is stated, walk to and from their homes to the bridge and then cross on the cable railway at a cost of 5 cents for a round trip (2 rides). By discontinuing the cable service these persons would be compelled, if they rode over the bridge, to pay 5 cents each way, or 10 cents a round trip. A formal protest was made by these citizens against the discontinuance of the cable railway service. Bridge Commissioner Shea says it is a case of the "greatest good to the greatest number."

WIRELESS TELEGRAPHY.—Mr. W. J. Clarke, on the evening of April 6 lectured before the New York Electrical Society on the subject of "Wireless Telegraphy." By means of lantern slides illustrations of the various instruments used were projected upon the screen. The receiving apparatus was shown, and then a diagram of connections showing the method used by Marconi in transmitting signals. The speaker explained the Marconi system, and then described some of his own improvements. He has designed two distinct sets, each consisting of transmitting and receiving devices. One set is capable of transmitting intelligible Morse signals, and the other is used where a cheaper class of apparatus is desired and where it is only necessary to ring a vibrating bell or operate some similar piece of apparatus at the receiving station. The transmitter is the same in both cases, and consists of an induction coil specially wound, so as to give the most suitable kind of secondary spark. This coil is mounted upon a mahogany base, together with a specially arranged vibrating device, and Morse key, the condenser of the coil being so connected as to kill the spark at the key contact, as well as at the contact of the vibrator. On the upper part of the coil are mounted two brass balls, which are 1½ inches in diameter, and arranged so that the distance between them can be adjusted within reasonable limits. When the coil is connected to a suitable battery the key pressed sparks will pass between these two balls, and electric waves will be sent out into space. He found that the greater the distance between the balls the better the effect, provided, of course, that the sparks pass quite freely. He has discarded the use of oil altogether, except in very large transmitters for long distance work. The transmitter, with 1½-inch balls, is capable of transmitting to reasonable distances. The receiver consists of two separate instruments, the de-cohering apparatus mounted upon one base, and a special relay and sounder, together with suitable switches and connections, mounted upon another base. The coherer consists of a glass tube about 2 inches in length, fitted with two brass plugs, arranged with spring and screw adjustments to each, so that the distances between the plugs in the tube, and their pressure upon the filings can be readily adjusted at will. The magnets of the de-coherer are specially wound, so as to overcome the effect on the tube of too much self-induction. Every desirable adjustment is provided for, so that not only can the distance between the magnets and the vibrating armature be adjusted, but also the tension of the spring on the front of the armature and the distance through which the armature vibrates. In this way it is possible to so adjust the coherer that the vibrating armature will strike the tube with just the proper strength of blow, so that the filings will not de-cohere except on the instant that the key is raised at the transmitting station, and on the other hand, the plugs in the tubes are so adjusted that the filings will immediately cohere when the electrical waves strike the tube, on the key of the transmitter being pressed. The relay in this case is wound to a very high resistance, and is placed in series with the glass tube and one cell of dry battery. Its armature is made as light as possible, so as to respond to the most feeble current, and its local contacts are so arranged as to operate the telegraph sounder, and the de-cohering apparatus in multiple, using about twelve cells of dry battery. The de-cohering apparatus used in the cheaper set of instruments is not provided with as many adjustments as the more expensive set, but these are not found to be necessary where it is only required to operate a signal similar to a vibrating bell. The relay used in this set is also of a smaller pattern, and is not provided with any means of adjusting the distance between the armature and the magnet cores, these adjustments having to be made by means of the screws at the back and front of the armature. The relay in this case is mounted on the same base with the electric bell or buzzer which it is intended to operate, and the whole outfit gives excellent results for signaling of this kind. Mr. Clarke stated that he had found it necessary to have a special form of dry battery made for this purpose, it being so constructed as not to deteriorate for a very long time, but at the same time it is only intended to be used with apparatus of this kind where a very small amount of current is required. He then illustrated the connections of his best apparatus, and called attention to the manner in which the condenser is connected, so as to include the Morse key as well as the vibrating contacts. An animated discussion followed Mr. Clarke's remarks, in which many interesting facts were developed. The plates, Mr. Clarke stated, in reply to a question, should be placed parallel. They thus give far better results. As regards the influence of intervening objects he stated that for short distances he could transmit through fire-proof walls for a considerable distance. Professor Pupin, during the discussion, stated that as far as he could see Mr. Marconi's apparatus does not represent the solution of the most important problem in connection with long distance signaling without wires, or rather, long distance signaling by means of electrical waves. This problem can be stated as follows: To construct an electrical oscillator of very short period, say, one hundred thousand million vibrations per second, the vibrations having a small decrement; that is to say, the vibrations having once started should continue for a considerable number of periods, say 500 or 600 periods. Vibrations of this kind are necessary, it seems to him. They should have very short wave lengths, so as to permit the construction of reflectors of reasonable size which could focus them, and they should have a small decrement, so as to be capable of producing powerful resonating effects, for without that selective signaling becomes impossible. So far as he knew nobody had been able yet to produce electrical waves of excessively short period, and at the same time possessing small decrement, because to produce these rapid oscillations it is necessary to connect small conductors to the terminals of the induction coil, and in such cases the radiation of the electric waves is so enormous that the waves die out very rapidly, so that after the first half wave there is hardly anything left. This was the trouble, for instance, with the waves produced by Professor Lodge and others. It was on that account that successful experiments on the reflection and the interference of electrical waves became almost an impossibility. In a recent discussion given by Professor Lodge, this difficulty has been emphasized more or less forcibly. As Mr. Marconi offers no suggestion in the line of solving this problem, President Pupin continued, and without the solution of this problem selective signaling by means of electrical waves will be made an impossibility, he thought the commercial utility of the system will remain more or less small.

New England Notes.

Branch Office of The Electrical World,
Room 91, Hathaway Building, 620 Atlantic Ave.,
Boston, Mass., April 16, 1898.

BY THE ACTION of the Massachusetts Legislature and the signature of the Governor the "electric chair" succeeds hanging as the method of putting condemned criminals to death in this State, all executions to occur at the State prison, in Charlestown.

VOLUNTEER ELECTRICAL CORPS.—Following the initiative (accepted by the United States Board of Engineers) taken by Capt. Eugene Griffin, vice-president of the General Electric Company, in the organization of volunteer corps of electrical engineers and skilled electricians to be identified with the preparation of effective coast defenses in the event of war ,the Volunteer Electrical Corps of Boston has become thoroughly organized and engaged in active work for the protection of Boston. The corps is officered as follows: Caryl D. Haskins, commander-in-chief; Dr. Louis Bell, chief executive and technical officer; Sidney B. Payne, second executive officer, quartermaster and adjutant in charge of all routine matters, and H. P. S. Forbes, corps orderly and staff messenger. The corps is divided into four divisions, three of fifty men and one of twelve, known as follows: Division I.—Division of Communication, having in hand all work of establishing communication to range and position finders, etc. This division is commanded by H. S. Kimball and the following as squad officers: A. R. Fisk, F. S. D'Humy, H. S. Potter and F. L. Barnes. Division II.—Having in hand all cable work, the running of lighting circuits, searchlights, etc., commanded by F. M. Kimball, with the following squad officers: L. L. Elden, George W. Dow, Harry Bottomley and C. W. Whitney. Division III.—Technical Division, having in hand all matters relating to mechanisms, instruments and equipment of submarine mines, in command of A. R. Bush, with the following squad officers: F. P. Cox, H. W. Brown, C. F. Dutton and C. B. Burleigh. Division IV.—Steam Engineering Division, devoted exclusively to the handling of power plants, commanded by Joseph A. Grant, and one squad in charge of P. S. Cobb. The officers and men as above named are drawn from the General Electric Company, Boston Electric Light Company, Edison Electric Illuminating Company, Postal Telegraph Company, Marlborough Electric Light Company, Godfrey Electric Construction Company, and D. F. Potter & Co., electrical contractors. Quite a large reserve force is under the direction of "Patriarch" Frank Ridlon, who is acting as recruiting officer of the corps.

Philadelphia Notes.

Branch Office of The Electrical World,
929 Chestnut Street,
Philadelphia, Pa., April 18, 1898.

MR. FRANK J. SPRAGUE, of New York, will describe the multiple-unit system of electric railways before the electrical section of the Franklin Institute at 8 P. M., Tuesday, April 26.

AN ORDINANCE was introduced in the Common Council recently, granting privileges to the Drawbaugh Telephone Company to lay conduits, erect poles and conduct the business of telephoning in this city. This company first applied to the Councils for like privileges in the spring of 1894.

THE EASTERN ELECTRICAL CONSTRUCTION COMPANY, Bourse Building, is the title of a corporation which has taken over the business of installation of telephone exchanges, etc., formerly conducted by Mr. W. D. Barnard. The company is now in a position to contract for the sale of all apparatus pertaining to the installation of telephone exchanges, using the West-

ern Telephone Construction Company's product. It also proposes to sell, build and install telephone systems, selling standard cables, cross arms, insulators, braces and pins and other appliances in connection therewith. Mr. W. D. Barnard is the general manager, the other officers of the company being Edward Davis, president; H. C. Young, vice-president; E. M. Yarnall, secretary and treasurer.

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., April 16, 1898.

TWO NEW TRANSFORMERS have been placed in the electro-chemical works at Niagara Falls.

THE BELL TELEPHONE COMPANY is running a new line from Wellsville to Olean, including Portville, Ceres and Bolivar in the circuit.

NORTH TONAWANDA is in difficulty over the failure of its city charter to provide for the letting of lighting contracts by the aldermen. Mayor Smeaton has called a public meeting to discuss ways and means.

THE BUFFALO TRACTION COMPANY is still in trouble with the city, which refuses right of way through the streets. It was in reality formed because the old street railway company could obtain no franchises, and now is not faring much better.

THE TELEPHOTOS of C. V. Boughton, which has had an eventful career, is again to the fore, and the works at Seventh and Hudson Streets are running extra time. This instrument was invented here several years ago, being a device for signalling at sea or over any long distances by the display of the Morse alphabet or other characters from a framework by means of electric lights. The inventor for a long time failed to interest any government in his invention, though he spent considerable time in Europe trying to introduce it. Lately our own Government has adopted it, and is now ordering apparatus faster than it can be made. One order consisted of 3000 extra electric lamps.

ELECTRICITY may settle the dispute between the Buffalo Common Council and the park commission over the location of the new waterworks pumping station. The Council wants a piece of land that is controlled by the park commission, but the objection to steam and coal smoke has led to a refusal on the part of the latter. It is now proposed to do the pumping by electric power, and a half agreement has been reached. Steps will be taken at once to determine the cost. An electric motor will be attached to one of the city pumps for the purpose of pumping. It came out in one of the conferences that the electric company refused to make a rate on the current to be furnished. One commissioner, who is at the head of a large store, also stated that he was unable to obtain a contract for lighting and running the power in the store for longer than two months.

MILWAUKEE NOTES.

MILWAUKEE, Wis., April 16 1898.

A VERY COMPLETE electric power and lighting plant is being installed at the Western Leather Company's works. Power will be furnished by a 37½-kw and a 30-kw Northern generator, direct connected to Skinner engines, to motors aggregating 200 horse-power. All the motors are of the Northern make. Part of the plant has been in operation long enough to show a saving in coal expense of 40 per cent. A. M. Patitz is consulting engineer, and Julius Andrae & Sons Company contractors for this plant.

THE SEVENTEENTH ANNUAL MILWAUKEE INDUSTRIAL EXPOSITION will be held in the Exposition Building in this city from September 10 to October 15 next. Engines and other motors and steam generators, railway and car fixtures and vehicles will be exhibited in Section 2 of Department A, which will be devoted to general machinery and machine tools. In Section 4 will be shown iron and other metal working machinery and machine tools. Section 5 will be devoted to mining tools and machinery. Section 5 of the Liberal Arts Department will take in telegraphy, electrical apparatus and instruments. Section 3 will be devoted to apparatus, instruments for medical art, surgery, etc., and Section 4 to apparatus and instruments for instruction and scientific investigation. Mr. A. Trumpff is secretary and manager, his address being the Milwaukee Industrial Exposition.

ST. LOUIS NOTES.

ST. LOUIS, MO., April 15, 1898.

CENTRAL TRACTION BILL PASSED OVER THE VETO.—The Central Traction bill, embodying the North and South Street railroad scheme, was passed by the Municipal Assembly Tuesday night over Mayor Zeigenheim's veto.

THE ST. LOUIS & KIRKWOOD ELECTRIC RAILWAY COMPANY made application last Monday to the County Court for a franchise to build a road to connect the St. Louis & Suburban and the St. Louis & Kirkwood lines.

AN ORDINANCE granting the right to operate funeral cars over every street railroad in the city will be introduced in the Municipal Assembly at an early date. Whether the privilege will be asked for in the name of a street railroad company or by private parties has not yet been determined.

ON MONDAY last the St. Clair County Turnpike Company secured an attachment against the officers and employees of the Day Electric Railway to appear before the Circuit Court at Belleville to answer to a charge of contempt in disobeying the injunction issued some time ago on the Day road by the officers of the Turnpike road.

ANOTHER STRIKE in the Electric Wire Workers' Union seems to be on the programme for June 15. It is stated that the inside wire men on that date will make a strike for a raise in wages from $2.50 to $3 per day. The cause assigned for the probable strike is that the work of the inside wiremen is limited to certain seasons of the year, and that enough has to be made during those seasons to maintain them during the year.

COLORADO NOTES.

DENVER, Col., April 11, 1898.

VOTE AGAINST ELECTRIC PLANT.—At the recent election in Silverton, Col., the proposition to bond the city for the construction of an electric light plant was defeated.

A FRANCHISE has been granted to J. D. Babcock to build a telegraph and telephone line to Evergreen, from Morrison, a distance of 14 miles. It is provided in the franchise that work is to begin in three months, and the line is to be in operation within six months. Morrison is about 19 mles from Denver.

DENVER STREET RAILWAYS.—W. G. Evans, secretary of the Denver Tramway Company, has recently sent a communication to the Chamber of Commerce, showing that Denver is extraordinarily well provided with transportation facilities. It is shown that the city has approximately 150 miles of electric and cable railway, or about 1 mile of railway for each 1000 of the population. Denver, says Mr. Evans, has a greater mileage of street car tracks and has a greater number of cars operating over them than any city of its population in the United States or the world. During 1897 the road carried 19,000,000 passengers and the cars traveled 6,000,000 miles.

REVEALING CONTENTS OF TELEGRAMS.—George J. Germain recently pleaded guilty in the County Court in Denver to having bribed a clerk in the Western Union Telegraph office to reveal the contents of certain telegrams addressed to Denver business men. Germain was in the grain business, and was able to make important sales and purchases by learning the information sent to his competitors. He was fined $100 and costs on each of the six cases against him. The court said that but for the recommendations of the district-attorney he would hold it to be his duty to sentence Germain to the full term of imprisonment in each one of the cases, as in his judgment the defendant had committed a most heinous offense.

ELECTRICAL EQUIPMENT OF CABLE RAILWAY.—The ordinance granting the Denver City Railroad Company the right to change its motive power from cable to the trolley has not yet been passed by the City Council. The ordinance is still in the hands of the street railway committee. The hitch seems to be that the committee and the company cannot agree on the life of the proposed franchise. The committee, it is said, wants to limit the life of the franchise to ten years, but the company is reluctant to accept an ordinance so limited in time in exchange for its present right, which is claimed to be perpetual, even though the desired privilege of using electricity be granted. It is announced that there is considerable dissatisfaction existing among the stockholders and bondholders of the road, especially since the January interest on the bonds was not paid. The manager of the company, E. C. Baggs, states that while it was impossible to meet interest charges, yet the company has no floating indebtedness. He was confident that if an electric system was installed operating expenses would be decreased to such an extent that it would be no longer necessary to default on interest charges.

PACIFIC COAST NOTES.

SAN FRANCISCO, Cal., April 9, 1898.

IT IS REPORTED that the Spreckels Sugar Company has shipped materials to King City, Cal., for the construction of an independent telephone line from that town to San Francisco. The distance is 163 miles.

THE PACIFIC ARC LAMP COMPANY, San Francisco, recently filled some large orders, including one from the San Joaquin Valley Railroad Company, which will use the lamps in tunnel construction work. Dr. Duncan, the inventor, is in charge of the factory.

LAKEVIEW, ORE., is to be lighted next summer from a water power electric plant, which will be installed by J. A. Anthony at a point about 9 miles from the town. The water of Cottonwood Creek will be used for motive power, but a steam engine will be used to drive a dynamo within the next thirty days. The new central station will replace the one recently burned.

THE MARKET STREET RAILWAY COMPANY, San Francisco, is pushing the electrical work on its Park & Ocean line, south of Golden Gate Park, which is being changed over from a steam road. Three electric locomotives have been contracted for, which will each be equipped with four General Electric motors of at least fifty horsepower each. Fourteen "G. E. 1200" car equipments have been ordered. The Reger-Atwater Company will supply overhead material.

COPPEROPOLIS, CAL., is named as the principal place of business of the recently incorporated Union Electric Power & Light Company; capital stock, $1,000,000; objects, to obtain power from the water of the Stanislaus River, and furnish light and power for mines and towns. The plant will be located on the river below the town, it is said. The stockholders and trustees of the company are Oliver Ames and Samuel Carr, of Boston; G. M. McRoss and Benjamin Johnson, of Copperopolis, and F. D. Nicol, of Stockton. Coulterville, Cal., will be supplied with electricity. The large copper mines will be reopened.

PROF. F. A. C. PERRINE, who has been acting as consulting engineer for several large electric companies since he accepted the chair of electrical engineering at Stanford University, is now doing consulting work in connection with the propositions to utilize the surplus water power of the Blue Lakes Water Company. The Standard Electric Company of California will retain Professor Perrine as its consulting electrical engineer. It is understood that he will resign his position at Stanford next June. The Standard Company is controlled by Prince Andre Poniatowski and associates, and it will possibly install a plant to transmit electric power from Blue Lakes to San Francisco, 110 miles.

THE MILITARY AUTHORITIES are making provision for the proper defense of San Francisco Bay as rapidly as possible. Bids have been received and forwarded to Washington, D. C., for the construction of two telegraph lines, one running through the Presidio of San Francisco and the other along

the opposite side of the bay, connecting the batteries and Fort Baker with the military headquarters. No. 9 galvanized wire is called for, suitable for either telegraph or telephone service, as required. It is understood that an ample supply of modern torpedo material is on hand, and that electric apparatus for submarine mines has been secured. The shore connections or torpedo casemates have been established. Details are not divulged.

Canadian Notes.

Ottawa, Ont., April 15, 1898.

THE MONTREAL STREET RAILWAY COMPANY is building twenty motor cars for the Kingston, Jamaica, Street Railway.

THE HALIFAX ELECTRIC STREET TRAMWAY COMPANY will spend about $50,000 in improving its plant. It has just installed two large generators.

MR. E. F. HUTCHINGS and others, of Winnipeg, Man., ask power from the Provincial Legislature to construct an electric or steam railway from Winnipeg along the east side of Red River to St. Andrews Rapids.

THE OTTAWA ELECTRIC LIGHT COMPANY has been given the exclusive privilege of supplying light and power in the city of Ottawa, on the condition that the price of light be reduced 40 per cent. This is the result of an application made by the Deschenes Electric Light Company to be allowed to supply light and power to the people.

THE INGERSOLL PACKING COMPANY has contracted with the Canada General Electric Company for a complete installation of incandescent lamps, arc lamps, motors and generators for its factories at Ingersoll, Ont. It is said that this contract was awarded after very mature considerations of the relative merits of two-phase alternating as against direct current machinery for isolated lighting and power service.

IN RESPECT TO the proposed auto-car service, to be established between Toronto and Richmond Hill this summer, it is said the initial car will be fitted with electric lights and buttons for the use of conductors and passengers, by which a warning may be given the motorman to turn to the right or left. It is claimed that this car will develop sufficient power to ascend heavy grades between Toronto and Richmond Hill at a speed varying from 6 to 12 miles per hour, carrying a full complement of passengers.

BY AN AGREEMENT entered into upon the commencement of the road Mr. J. H. Beemer had a two years' option for the purchase of the Quebec Street Railway. It is now said to be his intention to purchase the road and to consolidate it with the Quebec, Montmorency & Charlevoix Railway. The motive power of the latter road will at once be converted from steam to electricity. Later on an extension of the road will be made to Murray Bay.

THE FINANCE COMMITTEE of the Council for the city of Hamilton, Ont., recently considered the application of the street railway company for concessions, decided to ask the railway company what was the value of the property, and if it were prepared to sell and on what terms. If the railway company decides it will not sell, it is unlikely the Aldermen will grant any concessions, and if it is willing to dispose of the plant at a reasonable figure the city will purchase the road and own and run it.

English Notes.

(From Our Own Correspondent.)

London, April 6, 1898.

THE TELEPHONE SITUATION.—A debate in the House of Commons on the telephone question took place on Friday last, and was continued for a space of nearly four hours. A resolution was moved censuring the Post Office for refusing to grant municipal licenses as it has recently done in Glasgow and Huddersfield. Many points were urged in favor of a municipality being given Parliamentary power to erect telephone exchanges, while on the other hand it was advocated that it was high time the Government took over the whole telephone system of the United Kingdom. In reply to the resolution Mr. Hanbury, who represents the Postmaster-General in the House of Commons, gave a very fair exposition of the situation. He pointed out that the market value of the National Telephone Company's capital was at present about £6,000,000, whereas the Post Office authorities estimated the actual value of the plant at only £2,000,000. Under these circumstances he did not think it would be advisable to purchase the National Company's undertaking, but rather to wait until 1911, when the company's license expires in due course. The Government had the option of purchasing in 1890 and in 1897, the purchase price to be fixed by arbitration, but they did not avail themselves of the opportunity, neither did they intend to purchase in 1904, when they will again have the option. The whole subject is to be again inquired into by a Select Committee of the House of Commons. Such a committee was appointed in 1895 and did a great deal of work in examining witnesses, no fewer than thirty-one having been examined, and over 5000 questions being put. There was, however, no result from these proceedings and it is to be hoped that this waste of time and energy will not be repeated. Mr. Hanbury seemed to favor the idea of the Post Office itself starting competing exchanges more actively and with more success than they have done hitherto. It would be useless to give companies licenses, as in all cases where this has been done the licensees have eventually been absorbed by the National Telephone Company, rendering the position of the latter all the more secure. There are also many points in favor of and many against the granting of licenses to municipalities, all of which will, no doubt, be thoroughly threshed out by this Select Committee.

WIRELESS TELEGRAPHY.—Two interesting, but elementary papers on this subject were read on Wednesday last. The first was by Captain Kennedy, of the Royal Engineers, and was read at the Royal United Service Institution. He gave some interesting particulars of the recent work which had been done in England toward the realization of a practical method of signaling with Hertzian waves. The Post Office, he informed us, has severed its connection with Signor Marconi since the formation of the Wireless Telegraph and Signal Company. The latest experiments were carried out between Bournemouth and the Isle of Wight, over a distance of 18 miles of sea. Vertical wires 90 feet high were used at each end, and both the transmitting and receiving apparatus had been modified to render them simpler and more portable. The transmitter was a 6-inch induction coil worked by a portable dry battery. Oil around the spark gap has been discarded and the size of the knobs has been considerably reduced. It will be remembered that an 18-inch coil was used in the original experiments at Cardiff. Both balloons and kites have been successfully tried to lift the vertical wires. Captain Kennedy himself has had a very favorable experience with a form of tailless kite, due to Captain Baden-Powell. These kites require very little wind to raise them, and it was found in some experiments on Salisbury Plain that the average time taken to send up the kite and fix the receiver was only three minutes. The experiments between Bournemouth and the Isle of Wight were very succcessful, distinct and legible signals having been obtained. Other experiments were tried between Bath and Salisbury Plain, a distance of 35 miles, but owing to the stormy weather they had to be abandoned. It was thought that communications of signals were transmitted, but nothing legible could be recorded. Mr. Marconi, who was present, spoke a few words, but the chief contributor to the discussion was Mr. W. H. Preece, who remarked that the induction method, which had also been described in Captain Kennedy's paper, was working successfully across the mouth of the Bristol Channel. Experiments had also been made by this method across the St. George's Channel, using lines from Carlisle to Haverfordwest and from Belfast to Wexford, but it was found that the disturbances produced by the swaying to and fro of the earthed receiving lines, in the earth's magnetic field, rendered it impossible to distinguish any signals received. Mr. Preece also made a statement to the effect that he had never heard or read of any description of a method of practical telegraphy by means of Hertzian waves until Signor Marconi came to him with his apparatus. The second paper was read by Prof. Silvanus P. Thompson at the Society of Arts. The speaker divided "Telegraphy Across Space," as he called it, into three classes. First, the conduction method, in which moist earth or water was the medium. This he considers the most effective for distances under 3 miles. Second, induction methods, and thirdly, the wave method by electric-wave propagation. He expressed the opinion that it was possible to develop each of the three methods so that by any one of them it would be possible to effect electric communication between Europe and America. It was certainly possible, he said, to do this by induction or conduction, but whether it was possible by waves he was somewhat less certain. Some years ago he had seriously offered to a city friend to establish telegraphic communication with the Cape provided £10,000 were forthcoming to establish the necessary basal circuits in the two countries, and the necessary instruments for creating the currents. This he had intended to do by the induction method, which had first come to his notice through hearing that a Langdon-Davies phonophore could set up disturbances in other circuits 100 miles away. His offer had been deemed too visionary for acceptance then, but he still maintains that the thing was quite feasible, and states that his offer still holds good. We have no confirmation in England of the reports circulated in America that the company formed to exploit Marconi's invention has been abandoned. Prof. O. J. Lodge is working assiduously at the problem, but there is no doubt that he has not given vent to the utterances attributed to him by certain imaginative reporters.

French Notes.

(From Our Own Correspondent.)

Paris, April 1, 1898.

ELECTRIC CARS.—The Compagnie Générale des Petites Voitures, of Paris, will put in service in a short while 250 automobile electric cabs. Successful trials have been made upon several types of accumulators. It is hoped that the lighting companies will deliver charging current for these at 0.25 franc (5 cents) per kw hour. If not special charging stations will be installed by the cab company. The Société Générale des Transports Automobiles has just been organized to construct and exploit automobile vehicles of all sorts for both private and public uses. The capital is $250,000, divided into shares of $100 each.

ELECTRIC LIGHTING COMPANIES IN PARIS.—At the meeting of March 29 the Municipal Council was busied with the question of the electric lighting companies. In a former letter I said that the city of Paris did not wish to renew electric lighting concessions or to prolong those of companies who still have some years to run under their present franchises. This painful state of things, shown by several municipal councillors to be impossible, has at last moved the Council, whcih has ordered the whole subject reported back to its first committee. It is an excellent time to settle the matter, for while, on the one hand, the city would lose the taxes that the increase of electric lighting might bring in, on the other hand the companies would lower their rates, now too high, if they were assured that in the near future their concessions would be renewed. It is necessary, at any cost, to rapidly heal this difference, and thus assure to the city, for the exposition of 1900, a light worthy of it.

THE CENTRAL STATION OF THE QUAI JEMMAPES IN PARIS.—The Paris Compressed Air Company is one of the concerns that has obtained a concession for electric lighting in one of the divisions of Paris. Not long ago it changed its plant and method of distribution and installed the new station on the Quai Jemmapes on the banks of the St. Martin Canal. This new station feeds two sub-stations, that of St. Roch and that of the Rue Mauconseil. From these sub-stations various feeders are led to points in the general system of distribution, which is of the three-wire variety. At the central station twenty Belleville boilers in five batteries of four each feed five engines, each of 1200 horse-power. (Two more similar engines will soon be installed.) These engines, of the vertical Corliss type, worked condensing, were built by the Société Alsacienne, of Belport, which also furnished the dynamos. These are of the external commutator type. The armature is composed of a Gramme ring

held at the sides by a cast-iron spider of thirty-nine arms. This turns at the outer side of the field magnets, which are built up of twelve polar pieces. Each dynamo gives 1500 amperes at 500 volts, or 750 kilowatts at 70 r. p. m.

THE "METROPOLITAIN."—At its meeting on March 28 the Senate adopted the project for the Metropolitan Railway voted by the Chamber of Deputies. The project has been returned to the Municipal Council of Paris from the special committee, which has concluded to adopt the project with the modifications voted by the two chambers. It is thus evident that peace has been made between the two parties, and that the future of the Metropolitain seems less dark, less dependent on uncertainties. These are the propositions adopted by the commission: (1) the prefect of the Seine is invited to present to the Municipal Council the projects for the construction of the Metropolitan Railway in conformity with the law of March 28, 1898; (2) a technical commission of engineers is constituted for the definite planning and execution of this railway, and an appropriation of 480,000 francs ($96,000) is made to cover the first expense; (3) for the proper assignment of the work on the substructure of the first part of the system, from the Porte de Vincennes to the Porte Dauphine, with branches to the Porte Maillot, the French contractors will be assembled and submit their plans; (4) the Council is asked to vote an appropriation of 3,000,000 francs ($600,000) to be taken from the loan fund, of which 500,000 francs are to be for the personnel of the commission and 2,500,000 for the work; (5) the prefect of the Seine is authorized to return to the Government the 16,000,000 francs remaining of the 20,000,000 francs voted by the Municipal Council for the participation of the city of Paris in the exposition. There is no doubt that this project will be accepted in its entirety by the Municipal Council.

NEW RESEARCHES AND NEW APPLICATIONS OF X-RAYS.—(1) M. Bonnier remarked at a recent meeting of the Académie des Sciences that the X-ray exerted some influence over vegetation. Experiments with various seeds, notably those of the bindweed, which were shielded from the effects of the electro-static and electro-magnetic field and from heat radiations, showed that sprouting is hastened very appreciably by X-rays; (2) M. Bordier has studied the effects exercised by X-rays upon the phenomena of osmose and endosmose. When it is remembered that this class of phenomena play a capital part in the nutritive exchanges of the tissues, it is seen that modifications brought about by X-rays may furnish the key to the physiological actions of these rays so often noticed. M. Bordier, by a disposition of apparatus permitting of the certain elimination of all electric actions, has noted, using saturated solutions of sugar and of sodium chloride, that the rapidity of endosmotic action is considerably diminished by the action of X-rays upon the membrane. This action can reduce the normal quantity of matter traversing the diaphragm to one-third; (3) on March 14 last M. Marey communicated to the Académie des Sciences a paper by Dr. Foveau de Courmelles upon some researches undertaken by him in collaboration with M. Ducretet at the Institution des Jeunes Aveugles (Asylum for Blind Children) at Paris. Their object was to find out if the blind receive any impression from the X-ray. There are discordant opinions, as is well known, about the penetration of X-rays to the retina. The idea of these experimenters was to take as subjects the blind themselves. M. Foveau de Courmelles experimented upon 240 blind children, and, putting aside the optical illusions so frequent among such subjects, they perceived absolutely nothing from any of the three varieties of electro-luminous rays produced by the Crookes tube. The subjects having a vague notion of light, to the number of ninety-five girls and four boys, perceived X-rays, cathode rays and fluorescence. Others less gifted did not perceive the X-ray, but only the other two. With two subjects the luminous sensation was replaced by one of pain. A number of other anomalies of vision were noticed, perception of cathode rays only, of fluorescent rays only, etc. In brief, according to the authors, the retinas of certain blind subjects seem to take, as they never do in the case of normal eyes, the part of the sensitive photographic plate submitted to X-rays; (4) Dr. Mergier has just presented to the Académie de Médecine de Paris a new and very simple apparatus which, constructed after the plans of M. Radiguet, serves to show by the aid of X-rays the position of foreign substances that are imbedded in inaccessible parts of the body.

General News.

NEW INCORPORATIONS.

THE FARNHAM ELECTRIC COMPANY, Chicago, has been formed with a capital stock of $15,000.

THE DECATUR GAS & ELECTRIC COMPANY, Decatur, Ill., has been incorporated with a capital stock of $400,000. The incorporators are W. C. Johns and Joseph Housam.

SCOTLAND NECK TELEPHONE COMPANY, Halifax, N. C., has been incorporated with a capital stock of $4600. The incorporators are N. B. Jones, M. Hoffman and A. M. McDowell.

THE LA SALLE ELECTRICAL POWER COMPANY, Buffalo, N. Y., has been incorporated with a capital stock of $50,000. The directors are M. C. Spratt, R. C. Palmer and C. A. Pooley.

THE ATLANTIC COAST TELEPHONE COMPANY, Atlantic City, N. J., has been formed by Edwin L. Reinhold, Marietta, Pa., and Lewis Kuehule and James B. Reiley, Atlantic City. Capital stock, $100,000.

THE MORROW COUNTY TELEPHONE COMPANY, Mount Gilead, Ohio, has been organized with a capital stock of $12,000. The company is authorized to maintain telephone lines in Morrow, Richland, Delaware, Marion, Crawford and Knox counties, Ohio.

THE SAYREVILLE ELECTRIC LIGHT & POWER COMPANY, Sayreville, N. J., has been incorporated with a capital stock of $4000. The incorporators are Peter Fisher, Edwin A. Fisher, Sayreville, and James R. Sayre, Jr., of Newark, N. J.

THE TELEGRAPH AND TELEPHONE.

WEST POINT, NEB.—The Nebraska Telephone Company proposes to establish a telephone exchange in this city.

CRANFORD, N. J.—The New York & New Jersey Telephone Company received a franchise from the Council committee.

SPRINGFIELD, ILL.—The Harrisonville Telephone Company has certified to an increase of capital stock from $8000 to $20,000.

EATON RAPIDS, MICH.—The New State Telephone Company expects to have its line completed to Lansing via Diamondale by May 1.

BOSTON, MASS.—The annual meeting of the stockholders of the New England Telephone & Telegraph Company will be held in New York on May 3.

ROSENDALE, WIS.—The Rosendale, Ladoga, Rogersville & Eldorado Telephone Company has been organized here to build a line connecting the four towns named.

JEFFERSON, IA.—The Jefferson Telephone Company has decided to connect with Grand Junction, and work will be commenced at once. This company connects with 225 towns in Iowa.

MELLEN, WIS.—The Bessemer line of the Wisconsin Valley Telephone Company is completed as far as Hurley. Work will be commenced on the line from Mellen to Abbotsford and Withee.

MENOMINEE, WIS.—The American Telegraph & Telephone Company recently made a deal in this city for the purchase of 20,000 extra long telephone poles. This is said to be one of the largest deals in cedar poles ever made in this city.

FORT DODGE, IA.—The City Council has passed an ordinance authorizing the granting of a franchise to the Fort Dodge Telephone Company. It is probable that a special election will have to be held in order to approve the franchise. The company is not yet fully organized, but its plans are already matured. It contemplates establishing long distance instruments exclusively, and will make long distance connections with outside points through the Postal Telephone Company.

MEMPHIS, TENN.—George W. Schening of this city has sold his telephone exchange at Corinth, Miss., to the Cumberland Telegraph & Telephone Company. This was one of the finest independent systems in the South, and consisted of 100 telephones, with the Viaduct Manufacturing Company's bells and a 150-number Utica switchboard, with No. 12 galvanized iron wire on cedar poles, and glass insulators. The Cumberland Company has also purchased the telephone exchange at Winona, Miss., which Mr. Harvey has been operating for about two years. Mr. Harvey had fifty instruments connected to one of the Viaduct Company's sixty-number switchboards. The Cumberland Company is gaining friends by the very conservative policy adopted by Mr. Leland Hume, its general manager, in dealing with owners of local companies in its territory. Since the Cumberland Telegraph & Telephone Company purchased the Southern Bell telephone interests, it has been making great improvements, and is now rapidly extending the long distance service south, east and west from this city. At present the lines extend about 100 miles south, where they branch off, going under the Mississippi River at Helena, Ark., and west along the Iron Mountain branch of the Southern Pacific Railway. The company will soon open offices at Pine Bluff and Little Rock, Ark.

ELECTRIC LIGHT AND POWER.

BOSTON, MASS.—At the town election Concord voted in favor of an appropriation of $35,000 for a lighting plant.

CRANFORD, N. J.—The township committee has granted a franchise to the Cranford Electric Light & Water Company.

EDWARDSVILLE, ILL.—The town of Bunker Hill is figuring on buying the electric light plant there to be sold soon.

CEDAR RAPIDS, IA.—At the election at Springville the proposition for electric lights was carried by a vote of 56 to 46.

CLINTON, IA.—The proposition for municipal ownership of the electric light plant at Boone was defeated with a light vote.

CLEVELAND, OHIO.—At a charter election on April 4, Huron, Ohio, voted almost unanimously in favor of an electric light system.

AMESBURY, MASS.—The electric light company will install another 80-hp generator, to be used for auxiliary power on Sundays and holidays.

WEST NEW BRIGHTON, N. Y.—An electric light plant is to be erected at Sailor's Snug Harbor to supply the grounds and buildings of that institution.

ALBANY, N. Y.—The Governor has signed the bill incorporating the Electric Water Power Company, of Oneonta, with power to construct dams on the Susquehanna River to develop power.

ROCHESTER, N. Y.—Lima will soon establish an electric power plant. The Trustees granted the franchise to Eastern capitalists some time ago, but the project was deferred until their action was ratified at the recent charter election.

GREENVILLE, LA.—At an election recently held on the question of giving the City Council authority to issue bonds to erect and operate an electric light plant under municipal ownership, the proposition was defeated. The city is lighted by a private corporation.

SPENCER, IND.—The Spencer Electric Light Company will add to its plant in the next sixty days one engine and boiler of 125 horse-power and an alternator of from 500 to 1000 lights, and the necessary apparatus for a complete incandescent system, including 6 miles of wire.

BERLIN, PA.—The electric light projectors have received sufficient encouragement to warrant them in undertaking to light the town. They will now proceed to negotiate for the necessary machinery, supplies, building site, etc. It will be June or July before the work can be finished.

PITTSFIELD, MASS.—The Lee Electric Light Company, finding that its plant on Canal Street was inadequate to furnish power for the large number of lights required, has purchased the Garfield brick mill property. This, in addition to the East Lee property, will furnish facilities for years to come.

WABASH, IND.—By the terms of the new five-year agreement made between the City Council and the Wabash Electric Light Company, the latter will furnish all-night service at the rate of $75 per year for arcs and $18 for incandescents. This is a reduction of $15 per year on arcs and $5 on incandescents.

THE ELECTRIC RAILWAY.

SAGINAW, MICH.—The mayor has suggested to the Council the purchase and operation by the city of the electric street car line. The road is now in receivers' hands.

NEW YORK CITY.—The Village Trustees of Mamaroneck have denied the application of the Huguenot Electric Railroad Company for a franchise on the Boston Post Road.

LOS ANGELES, CAL.—The new postal service of collection and delivery by electric street cars was begun in this city on April 1. The cars will run through to Pasadena.

HAMILTON, OHIO.—The franchise recently granted by the Council to the Cincinnati & Hamilton Street Railroad Company will probably be resisted by the Hamilton & Lindenwald Electric Transit Company.

BELLEFONTE, PA.—A charter has been granted to the Elk & Highland Railroad to build a 17-mile road from Coon Run station in Elk County to Portland, connecting with two railroads. The capital is $102,000.

NEW YORK CITY.—The Union Railway Company, which obtained a franchise from the village of Pelham to lay tracks to New Rochelle, will have to change its route, as objection is made to passing through Sycamore Park.

BROOKLYN, N. Y.—At the last meeting of the Business Men's Association of Jamaica a resolution was passed favoring the construction of a cross country trolley line connecting Jamaica with Flushing and Long Island City.

SYRACUSE, N. Y.—Application has been made to the Common Council for a new trolley line in the western part of the city. The petition is signed by citizens connected with the Lehigh Valley Railroad, and it is supposed the new venture will be a branch of that road. The new company is a rival to the Syracuse, Skaneateles & Moravia Railroad, which already has a petition before the Council.

PITTSBURG, PA.—Mayor Corothers, of McKeesport, has signed the ordinance granting the McKeesport, Duquesne and Wilmerding Street Railway Company a right of way on Jerome Street, that city. The ordinance will give the company a direct route from McKeesport to Duquesne, from which place a track is to be laid to connect with the Homestead & Highland road, making another route from McKeesport to Pittsburg.

NEW YORK CITY, N. Y.—A Cincinnati dispatch states that twenty women, who recently rode in from Cumminsville, went in a body to the office of President Kilgour, of the Cincinnati Street Railway Company, and positively refused to leave the premises until he promised to take steps to abate a nuisance to which they called his attention. As a result, he sent out instructions forbidding conductors to eat onions within twenty-four hours of going on duty.

WAUKEGAN, ILL.—A new electric railway, extending from Libertyville northwest to the chain of lakes region, is projected. Dr. E. C. Weeks, of Nashua, Ia., is seeking a franchise from the Village Board of Libertyville. He represents a company with ample capital. A special committee of Trustees is investigating the project. The projected road will commence near the Chicago, Milwaukee & St. Paul Railroad depot at Libertyville, and run to Milwaukee Avenue, and thence northwest to the lake region.

PERSONAL NOTES.

MR. N. G. HARVEY has resigned his position with the Central Electric Company, Chicago, to accept the management of the house goods department of the Illinois Electric Company. Mr. Harvey has been in the business a number of years, and has a host of friends among the electrical fraternity.

MR. C. S. KNIGHT, vice-president of the Fort Wayne Electric Corporation, was in New York last week on business. Mr. Knight has recently returned from a trip to California. He says business is picking up on the Coast, particularly in the transmission line. The Fort Wayne Electric Corporation has just made a new addition of a gallery factory, 206 x 68 feet, for the manufacture of heavy work. It has also completed a laboratory, 150 x 38 feet.

MR. ARTHUR BERGTHIEL, of the firm of Bergthiel & Young, London, England, is in New York. His firm represents in England the Fort Wayne Electric Corporation, the Micanite Company, Eugene Munsell & Co., and the H. W. Johns Manufacturing Company, all well-known American concerns. Mr. Bergthiel proposes to extend his business by handling American electrical specialties, and will, while here, make arrangements with that end in view.

MR. E. R. KNOWLES, electrical, civil and mechanical engineer, has become connected with the Sprague Electric Company, New York, and will have entire charge of the power motor department. Mr. Knowles is a Californian by birth, but has spent almost his entire life in the East, where, as an engineer for electrical installations, he has attained an enviable reputation. He is an inventor of some note, and his reputation and ability will surely prove of great value to the Sprague Company. Both parties to the arrangement may well be congratulated on the new alliance.

TRADE PUBLICATIONS.

THE ILLINOIS STEEL COMPANY, Chicago, has issued a book of forty-two pages, describing in detail its large plant, which embodies many interesting electrical features.

"ABOUT TRAPS" is the title of a little pamphlet issued by the William S. Haines Company, 136 South Fourth Street, Philadelphia, Pa., telling all about the Heintz Steam Trap.

HIGH PRESSURE TUBULAR BOILERS is the subject of an attractive catalogue just issued by the Murray Iron Works Company, Burlington, Ia. The illustrations of these boilers are excellent.

TAPE TALK is the title of a leaflet just issued by the Central Electric Company, Chicago. It tells of the uses of Okonite tape and Manson tape, and how either or both may be obtained. Being right to the point it will command attention.

MESSRS. WILLIAM H. BRYAN AND HENRY H. HUMPHREY, consulting, mechanical and electrical engineers, Turner Building, St. Louis, Mo., have issued a little booklet announcing the scope and character of their business. They give a list of references including the names of many well-known concerns.

THE DIAMOND RUBBER COMPANY, Akron, Ohio, has issued a price catalogue of belting, hose, packing, mechanical rubber goods, pneumatic and solid cycle and carriage tires. The catalogue contains eighty-four pages, and is printed in two colors. The company has also issued separately a price catalogue of couplings, bands, reels, belt hooks, punches and awls. Everything manufactured by the company is listed in the two catalogues.

MESSRS. QUEEN & CO., Incorporated, Philadelphia, present in a new circular a description of their Queen-Acme portable testing set. Their claims on this instrument as to range and accuracy of measurement are very wide. The testimonials in the new circular suggest that the set is widely used, both in this country and abroad. This descriptive pamphlet will be sent on application to those interested.

BULLETINS 7 and 8 have been issued by the Warren Electric Manufacturing Company, Sandusky, Ohio. No. 7 relates to the Warren alternator, which machine is described in its constructional and operative features. Bulletin No. 8 is devoted chiefly to testimonial letters regarding the operation of Warren alternators. These letters speak well of these machines. Both bulletins are well illustrated.

THE McROY VITRIFIED TERRA COTTA CONDUIT is the subject of a neat little pamphlet issued by Mr. John T. McRoy, 915 Chamber of Commerce Building, Chicago, Ill. The process of manufacture, dimensions, installation and advantages of this conduit are all briefly but clearly set forth. An illustration shows a 6-foot length of conduit, supported at both ends on pieces of scantling and bearing the weight of 7 tons of pig iron, placed on top of the pipe.

THE AMERICAN ELECTRICAL DIRECTORY AND BUYERS' MANUAL for the quarter beginning April has been issued. This work is published by Mr. E. L. Powers, Monadnock Block, Chicago, and contains a complete list of electric lighting central stations in the United States, Canada and Mexico, with the capital stock, bonds, names of officials, number of arc and incandescent lights in use, system, voltage of current, horse-power of engines, boilers, etc. It also contains a complete buyers' finding list of the manufacturers of and dealers in central station apparatus and supplies, properly classified and arranged.

THE MANAGEMENT of the advertising and press department of the Sprague Electric Company, New York, judging from the catalogues published up to the present time, and the impression made by them in the trade, is in thoroughly capable hands. The latest piece of work in this line is a beautiful catalogue on the subject "Electric Motors in the Art of Printing." The front cover consists of a very artistic design in scroll work, with a vignette in the centre bearing the name of the company. It is very elaborately finished in gold, upon a dark green ground. The reading pages, of which there are ten, call attention to the advantages of operating printing presses by electric motors, and several very handsome illustrations show concrete examples of this class of driving, Lundell motors supplying the power. A comparison of the cost of steam and electric power is given. This is followed by a partial list of printing houses in various cities using this class of power, and the report of a test made on the American Book Company's electrically driven plant shows comprehensively the economies and advantages derived. Apart from the artistic features of the catalogue, information of the most practical and valuable kind is presented in its pages.

ELECTRICIANS' SHEET INSULATION MANUAL.—Probably one of the most useful and interesting books on insulation ever gotten up for the trade is now being mailed to the electric street railways and electrical manufacturers throughout the country by the Mica Insulator Company, New York and Chicago. In it are described the company's flexible and extra flexible micanite cloth and paper; "Empire" cloths and rope and bond papers; M. I. C. compound, insulating cloths and papers; flexible micanite plate, Style B; oiled asbestos paper; standard micanite plate, No. 1, and standard micanite No. 2 special. A considerable space is devoted to a description of the company's M. I. C. compound, which is now largely used throughout the United States. A great deal of information is given concerning the different classes of goods above mentioned, all of which will be valuable to electrical engineers. The oiled asbestos paper is a new product, and is generally used in connection with the "Empire" cloth. The two combined make a strong semi-fireproof insulation of very high resistance. Micanite plate No. 1 is suitable for general purposes, and No. 2 special is manufactured especially for commutator segments. The

Mica Insulator Company will be pleased to mail a copy of this book on application, and calls attention to the fact that its materials are carried in stock, both in Chicago and New York.

Trade and Industrial Notes.

I. P. FRINK, 551 Pearl Street, New York, is the exclusive American agent for the latest Parisian novelty in the form of flower shades in silk and velvet for electric lamps. They are particularly effective and have met with a gratifying reception.

THE HOLOPHANE GLASS COMPANY has opened an office in New York City at No. 1 Broadway, Mr. A. O. Mygatt being placed in charge. "The Diffusion of Light by Holophane Globes" was the subject of an article in the last issue of THE ELECTRICAL WORLD.

THE BALL ENGINE COMPANY, Erie, Pa., which builds engines exclusively for electrical work, is reported to be crowded with orders. The reputation of the Ball engines built by this company has no doubt much to do with the satisfactory condition of its order book.

THE A. A. GRIFFING IRON COMPANY, Jersey City, N. J., has placed with its selling agent, Mr. George G. Seamans, Pittsburg, Pa., a full line of samples of the Bundy steam specialties. Mr. Seamans has taken up the sale of these goods in the Pittsburg district.

MR. A. O. SCHOONMAKER, 158 William Street, New York, reports that there is a good demand for his solid sheet mica segments for railway commutators. He will be pleased to send samples to any road wishing to give them a trial. He has testimonials from many users of these segments.

MESSRS. DE VEAU & CO., 27 Rose Street, New York, manufacturers of telephones and equipment supplies, have received an order from the United States Government for telephones for a merchant ship which has been purchased by the Government to be turned into a warship.

THE CHAMBERSBURG ENGINEERING COMPANY, Chambersburg, Pa., has just completed a large shipment of portable riveters and cranes for the Schoen Pressed Steel Company, Pittsburg, Pa. The New York agents of the Chambersburg Engineering Company are J. D. Miller & Co., 39 Cortlandt Street.

MR. J. P. WILLIAMS, 39 Cortlandt Street, New York, general agent for the sale of "Paragon" desk and ceiling fans, is securing a good share of the fan trade that the modern springtime brings with it. His success simply verifies the well-known fact that a good article always finds a demand and a ready sale.

MR. M. R. RODRIGUES, 21 Whipple Street, Brooklyn, N. Y., manufacturer of "Premier products," has formed a company to be styled, after May 1, the M. R. Rodrigues Manufacturing Company. The company will continue to manufacture electrical specialties, and will also do a general electric construction business.

THE ELECTRICAL APPLIANCE COMPANY, New York, of which Mr. G. A. Nisbet is general manager, has moved its office from 39 Cortlandt Street to the Thames Building, Thames and Greenwich Streets. In its new quarters it has secured suitable facilities for the manufacture of its gravity motor controller.

SEALED PROPOSALS will be received at the office of the Board of Public Works of the city of Grand Rapids, Mich., until 2 o'clock P. M., April 28, for furnishing engines, boilers, dynamos, pole line, arc lamps, etc., for an electric lighting plant, as set forth in the specifications, copies of which may be obtained from the secretary of the committee. Mr. Dudley E. Waters is president and Fred A. Twamley clerk.

THE REORGANIZATION of the Davis & Egan Machine Tool Works, Cincinnati, Ohio, under the new title of the American Tool Works Company, has been effected in the manner outlined in the last issue of THE ELECTRICAL WORLD. Mr. Charles Davis was elected president, B. B. Quillan vice-president, and Henry Luers secretary and treasurer.

THE CENTRAL ELECTRIC COMPANY, Chicago, reports that there is an encouraging use of the various electrically heated utensils for cooking and other purposes. The adaptability of this type of apparatus to diversified uses seems to have struck the popular favor. The company carries all of the various heating and cooking appliances, and can make shipments from stock.

THE ERICSSON TELEPHONE COMPANY will, before May 1, be located at No. 20 Warren Street, New York, with its office on the ground floor. Its present quarters are at No. 10, the same street. The telephone system installed at the New York Athletic Club, the electrical equipment of which was described in the last issue of THE ELECTRICAL WORLD, is that of the Ericsson Telephone Company. Ericsson Swedish transmitters are used in this installation.

THE UNITED CORRESPONDENCE SCHOOLS, 154-158 Fifth Avenue, New York City, are teaching by correspondence several practical courses, including mechanical, steam and electric station engineering, electric lighting and raiways, and telegraph and telephony. The field of mechanic arts is well covered. The schqol is in charge of experienced and progressive teachers.

THE UNITED TELEGRAPH, TELEPHONE & ELECTRIC COMPANY is operating an exchange of about 500 'phones in that part of Chicago known as Hyde Park. The company contemplates enlarging its plant to 2500 instruments, and will receive proposals from contractors to do the work. The company has not yet decided whether to undertake the work itself or let it out to some good contractor. The company's main office is at 84 Washington Street, Chicago, Ill.

MR. C. W. BARTLETT, of Des Moines, Ia., has accepted the position of Western agent of the Keystone Telephone Company, Pittsburg, Pa., with headquarters at Des Moines. Mr. Bartlett is a practical telephone man, and did good work in building up the Mutual Telephone Company, of Des Moines, His practical knowledge combined with the first-class apparatus which he will represent, will no doubt bring plenty of business to the Keystone Company, and managers of telephone exchanges in general would serve their own interests by consulting Mr. Bartlett on matters pertaining to the business.

THE TORONTO ELECTRIC MOTOR COMPANY and the Thompson Electric Company (late of Hamilton, Ont.) announce that they will hereafter jointly carry on business under the name of the Toronto Electric Motor Company, Limited, with headquarters at Toronto. The united companies are now erecting a new factory, which will be fully equipped with modern tools for manufacturing and appliances for fully testing the finished work. Complete municipal and commercial arc and incandescent lighting and power plants in every detail will be manufactured. The office of the company is at 107 Adelaide Street, West.

MESSRS. EUGENE MUNSELL & CO., New York and Chicago, report that they are enjoying an excellent trade in their India and amber mica segments for railway motors. Several heavy orders have recently been received, one of which was probably the largest ever taken for mica segments from an electric railway. It called for more than 800 pounds of the India and amber segments. The firm carries a large stock of mica, both in the sheet and cut to size; and has large facilities, both at New York and Chicago, for executing orders promptly. They will take great pleasure in sending samples for trial to any electrical manufacturer, repair concern or street railway on request.

THE DIAMOND RUBBER COMPANY, Akron, Ohio, was recently reorganized, its capital stock being increased from $50,000 to $300,000. The company has been placed in a position to conduct its business on a large scale. Mr. Walter B. Hardy, who has been connected for twenty years with the Revere Rubber Company, Boston, has accepted the position of president and general manager. Mr. J. K. Robinson is vice-president, Mr. A. H. Noah treasurer, and Mr. C. H. Palmer director. The capacity of the plant is being doubled to take care of the large volume of new business offered to the company. Associated with Mr. Hardy in the active management and ownership of the company will be Mr. William B. Miller, of Buffalo, formerly assistant general manager of the Revere Rubber Company, and Mr. A. H. Noah, of Akron.

THE ELBRIDGE ELECTRICAL MANUFACTURING COMPANY, Elbridge, N. Y., announces that it no longer manufactures or sells the eight light, model and Midget dynamos which it formerly made, but has transferred this part of its business to the Electrical Apparatus Company, which will continue to furnish these machines. The members of the Electrical Apparatus Company have all been connected with the Elbridge Electrical Manufacturing Company, and have practical experience in the manufacture of the dynamos above referred to. Mr. A. E. Doman, the manager of the new company, was formerly chief electrician of the Elbridge Company. The Electrical Apparatus Company is fitting up commodious quarters for the manufacture of these machine, and will add, at an early day, a full line of auxiliary apparatus for experimental electrical work.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York City.

THE AMERICAN NAVY, CUBA AND HAWAII.—A portofolio, in ten parts, sixteen views in each part, of the finest half-tone pictures of the American Navy, Cuba and Hawaii has just been published, and the Chicago, Milwaukee & St. Paul Railway has made arrangements for a special edition for the benefit of its patrons, and will furnish the full set, 160 pictures, for $1. In view of the present excitement regarding Cuba these pictures are very timely. Send amount with full address to George H. Heafford, General Passenger Agent, C. M. & St. P. Ry., Chicago, Ill.

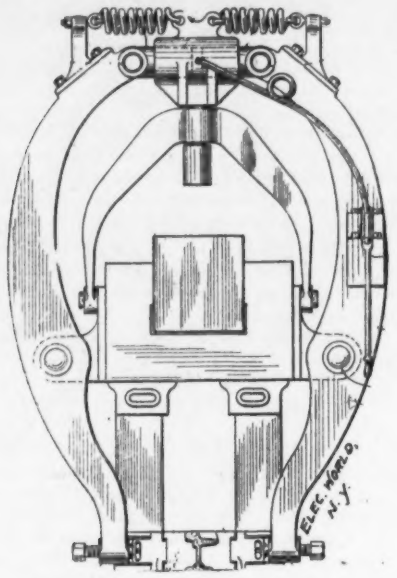
UNITED STATES PATENTS ISSUED APRIL 12, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

602,142. SUPPLY SYSTEM FOR ELECTRIC RAILWAYS; P. J. Pringle, London, Eng. App. filed Oct. 27, 1896. A system of electric traction, consisting of the combination of a rail or tramway track forming the return circuit, an electrically propelled vehicle on the track having collectors attached, which pick up the current from a series of surface plates or rails, a certain number of which form a block, and a shunt collector on the vehicle connected to return rail through a resistance also carried on vehicle, a main supply conductor from source of electricity and conductors from distributers to the separate sections of a block, a series of distributers, one for each block of sections, for successively connecting the current from the main supply to the said separate sections in exact relationship with the movement of the car or vehicle.

602,172. SECONDARY BATTERY; F. W. Schneider, Triberg, Germany. App. filed June 10, 1897. In combination, a supporting frame consisting of parallel perforated plates with spacing tubes and connecting bolts, and the electrodes consisting of the perforated tubes containing active material, said tubes being piled in the spaces between the plates and resting upon the spacing tubes.

602,174. TELEPHONE TRANSMITTER; H. E. Shreeve, Boston, Mass. App. filed Aug. 26, 1897. The combination of the vibratory diaphragm and front



No. 602,284.—Track Welding.

and back electrodes both mounted thereon, the former being rigidly and the latter elastically attached thereto; with a variable resistance medium composed of substantially spherical or rounded carbon granules or particles, held between and in constant contact with said electrodes.

602,176. STORAGE BATTERY; G. A. Washburn, Cleveland, Ohio. App. filed May 22, 1897. A storage battery electrode having on each side a series of groups of concentric ring-shaped projections of substantially uniform cross section one with the other, and equally spaced at all points to hold active material between them and standing out above the adjacent surface of the plate, and a hole centrally through each group communicating with the opposite side of the plate.

602,182. DYNAMO FOR ELECTRIC CAR LIGHTING SYSTEMS; E. J. Preston and A. B. Gill, London, England. App. filed Feb. 25, 1995. The combination with the driving axle provided with a pulley, of a dynamo provided with a pulley and mounted to be capable of movement toward and from the driving axle in a substantially horizontal direction, a driving belt applied to said pulleys, and means whereby the dynamo is pressed away from the driving axle, and the pressure is applied to the belt which is necessary for producing the desired normal speed of the dynamo, while the dynamo is drawn toward the axle by an increased speed of the belt, thereby loosening the belt and causing a slip which neutralizes such increase of speed, thus maintaining the desired normal speed of the dynamo shaft under an excessive speed of the driving axle.

602,208. ELECTRIC BLOCK SYSTEM; F. Burger, Fort Wayne, Ind. App. filed Aug. 2, 1897. In an electrical railway block system, the combination with the leading and return conductors of a series of insulated trolley sections, a series of section feeders, a normally closed switch for each section feeder located at the entrance of each trolley section and adapted to be engaged by the trolley, a connection between said switch and a rear trolley section, and a switch operating magnet in said connection whereby when a car enters a section the corresponding magnet is energized to open the switch and break the circuit controlling the rear section, and when the trolley leaves the section and enters a succeeding section the trolley operates the switch to restore it to its normal or closed position.

602,218. ELECTRIC TRANSFORMER; L. Gutmann, Pittsburg, Pa. App. filed Oct. 30, 1890. A core element for electric transformers consisting of a plate of magnetic material, two recesses or more provided in said plate for locating the transformer windings, polar projections caused by said recesses, and a second plate or strip of magnetic material, interlocking with the polar projections of the plate named first.

602,227. PROCESS OF FABRICATING METALLO-CERAMIC RESISTANCE; L. Parvilee, Paris, France. App. filed Nov. 13, 1897. Process of making metallo-ceramic resistances for electrical purposes, consisting in mixing a metallic powder with extraneous bodies, such as quartz, kaolin, clay or feldspar, and with a flux, subjecting the whole to pressure and then firing the same.

602,284. TRACK WELDING; R. Eyre, Johnstown, Pa. App. filed Sept. 22, 1897. The combination with the terminals spanning the ends of the rails, of dies and contacts detached from said terminals and secured directly to the sides of said rails, and an upsetting tool surrounding said terminals and secured to both rails.

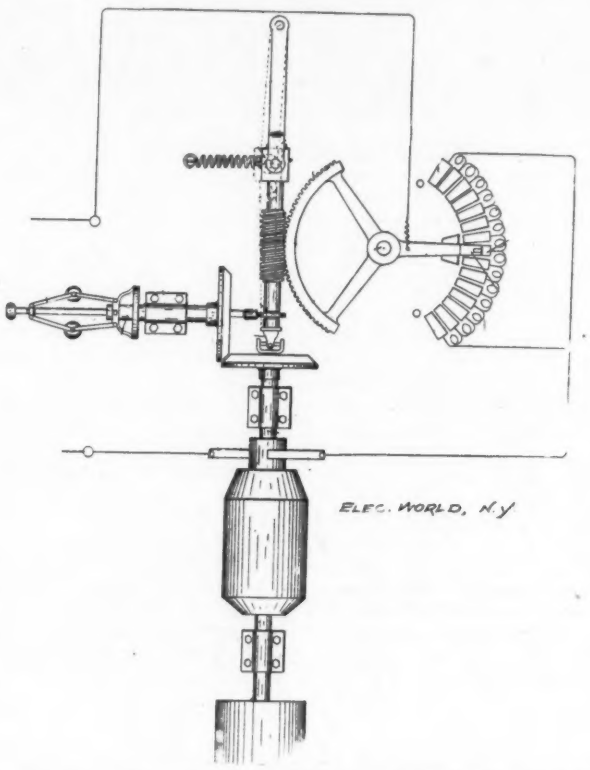
602,302. SUSPENDING BATTERIES ON CARRIAGES; R. T. D. Brougham and W. C. Bersey, London, England. App. filed Dec. 13, 1897. The combination of the carriage frame, a box, springs suspending the box from the frame, and a rod pivoted at one end of the frame and at the other to the box.

602,336. CONDUCTOR AND CONTACT DEVICE FOR ELECTRIC RAILWAYS; A. S. Krotz, O. S. Kelly, Springfield, Ohio, and W. P. Allen, Chicago, Ill. App. filed May 28, 1897. In a third rail electric railway system, the combination of insulating standards erected alongside the track, a working conductor supported by said standards on the inner side thereof at an elevation above the track, but below the upper ends of the standards, the said conductor projecting horizontally from the standard, and a transversely inclined or sloping cover resting on the tops of the standards and on the extreme edge of the horizontal portion of the conductor.

602,362. GALVANIC BATTERY; W. Rowbotham, Birmingham, England, App. filed Dec. 16, 1896. In a hermetically sealed electric battery, the combination of the depolarizing liquid compartment and the liquid expansion chamber located in juxtaposition to one another within the sealed battery, and tubular carbon elements communicating with said expansion chamber.

602,380. ELECTRIC ARC LAMP; E. Weber, Paris, France. App. filed Sept. 11, 1897. In voltaic arc lamps or regulators, having carbon holders connected by a cord or small chain, one of which carbon holders is heavier than the other so as to actuate them, the arrangement of a disc around which passes the said cord, of armatures mounted loose upon the spindle of this disc, and connected with a mechanical brake acting upon the disc and submitted to the action of a spring or of a counterweight, and of an electromagnet arranged in shunt upon the main circuit, and between the polar masses of which is arranged the disc and the armatures above referred to; the object of the said arrangement being, when the voltage increases at the lamp terminals and the electromagnet receives a proportional quantity of the current, to release the mechanical brake by the attraction of the armatures and to exert a magnetic braking upon the disc in such a manner that the carbons approach each other slowly, regularly and without jerks.

602,404. ELECTRIC ARC LAMP; J. Mueller, Cleveland, Ohio. App. filed Aug. 27, 1897. In an arc lamp, the combination with the carbon holding devices and a feeding clamp having sliding engagements with the upper carbon holder, of a lifting lever adapted to be engaged and lift said clamp, a spring acting on said lever to cause it to engage said clamp, a cross lever pivoted on the lamp frame, auxiliary levers, and thermo-expansive strips connecting the auxiliary levers, respectively, with the cross lever



No. 602,413.—Automatic Device for Removing Resistance in Starting Electric Motors.

and the lifting lever, and with the cross lever and a binding post to which the main circuit is connected.

602,413. AUTOMATIC DEVICE FOR REMOVING RESISTANCE IN STARTING ELECTRIC MOTORS; G. H. Whittingham, Baltimore, Md. App. filed Sept. 9, 1897. The combination of a driving shaft; a resistance included in the motor circuit normally or when at rest; a toothed resistance arm in engagement with said resistance; means adapted to engage said toothed arm when starting the motor, but disengaged therefrom when the motor is not running; a centrifugal governor serving to effect the said engagement at the time of starting the motor, whereby the said resistance is cut out, and means for returning the resistance arm to the point of greatest resistance when stopping the motor.